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CONTENTS



**MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.**

## *LINNÆUS AND AMERICAN BOTANY*[1]

I HAVE been asked to make a short address to you on Linnæus and his relation to North American botany. That the selection fell on me was not because I was the most able one to deliver such an address, for there are many abler men present, but simply because I was born in the same country as Linnæus. In fact, my grandfather came from the same province of Smaland and even from a parish adjoining that of Stenbrohult, in which my illustrious countryman was born.

In the early part of the seventeenth century there lived in Jonsboda, Smaland, Sweden, a farmer named Ingemar Svenson. He had three children, two sons and one daughter, the grandmother of Linnæus. On the Jonsboda farm stood a very large linden tree, so old and with so many traditions that it was regarded by the people as a holy tree. Any damage done to this tree, it was claimed, would surely bring misfortune upon the head of the perpetrator. When the two sons began to study for the ministry, it was natural that they should think of this tree in selecting a family name. They called themselves Tiliander; *Tilia* is the Latin for the linden or basswood, and *andros* the Greek for man. It may not be amiss to state that at that

[1] Address delivered at the New York Botanical Garden, May 23, 1907, by Per Axel Rydberg, on the commemoration of the two-hundredth anniversary of the birth of Linnæus by the New York Academy of Sciences.

time the common people of Sweden did not have any family names, and this is true to a certain extent even to-day. A man was known by his given name, the given name of his father with the word son appended, and the place where he lived. The farmer mentioned above was known as Ingemar Svenson from Jonsboda. His father's name was Sven Carlson and that of his grandfather, Carl Johnson. The names of his two sons would have been Carl and Sven Ingemarson had they remained in the peasant class, instead of Carl and Sven Tiliander.

The daughter married a farmer, Ingemar Bengtson, and her son's name was Nils Ingemarson, until he entered the "gymnasium." He was also born in Jonsboda and, when selecting a name, he naturally also turned to the same old linden tree as his maternal uncles had done. He called himself Linnæus. It is remarkable that two of his father's maternal granduncles also bore another Latin form of the same name, viz., Lindelius. Some claim that even this name was derived from the same old linden tree, but this is scarcely in accordance with the facts. More likely it traces its origin from the Linden Farm in Dannäs Parish, where their ancestors lived.

But what has this genealogy to do with Linnæus's relation to North American botany? Perhaps nothing directly, but indirectly a great deal; for the circumstances and surroundings under which a man is born and reared to a certain extent make the man. In his younger days, Sven Tiliander was the house-chaplain of Field-marshal and Admiral Viscount Henrik Horn, who was for many years governor of Bremen and Verden, two cities with territory in Germany acquired by Sweden through the Thirty-years War. During his stay in Germany, Tiliander learned to know and love botany and horticulture and established around Viscount Horn's residence in Bremen a garden which was remarkable for that period. When both returned to Sweden, Tiliander brought with him the choicest plants from this garden and planted them around the parsonage of Pjetteryd Parish, of which he had been appointed rector. Here at Pjetteryd Nils Linnæus spent most of his youth, studying in company with his uncle's sons. Later, both as curate at Rashult and as rector at Stenbrohult, he surrounded the parsonages with gardens, in which he grew many rare and interesting plants. In the midst of these, Carl Linnæus, the famous botanist, was born and reared. Later, while a student at the university, he spent a summer vacation at home in 1732, and made a list of the plants in his father's garden. This list is still to be seen in the Academy of Sciences at Stockholm. Although defective, the first four classes being unrepresented, it enumerates 224 species. Of these, many were at that time very rare in cultivation. Professor Theodore Fries in his biography of Linnæus enumerates 36 of the rarest of these. Among them we notice six American plants, viz., *Rhus Toxicodendron* (the poison oak), *Mirabilis Jalapa* (four-o'-clock), *Asclepias syriaca* (milk-weed), *Phytolacca decandra* (poke-weed), *Antennaria* — now *Anaphalis* — *margaritacea* (pearly everlasting) and *Solanum tuberosum* (the potato). It may be remarked that the cultivation of potatoes was introduced into Sweden about twenty years later. We see from this that Linnæus had learned to know some American plants even in his early childhood.

Carl Linnæus was born the thirteenth of May (old style), 1707, at Rashult, an annex to the parish of Stenbrohult. His father was the curate there, but two years later, at the death of his father-in-law, Samuel Broderson, he became rector and moved to

Stenbrohult. In the fall of 1714 Carl Linnæus entered the school of Wexiö, and graduated from the "gymnasium" in 1727. His parents, especially his mother, wanted him to study for the ministry, but he had no love for theology, nor for metaphysics, nor the classics. He learned Latin tolerably, however, because that language helped him to study the natural sciences. He decided to study medicine and entered with that view the University of Lund, which was nearest his home, but remained there only one year, learning that there were better facilities at Upsala. At the latter place he soon became acquainted with Professors Rudbeck and Celsius, two of the most prominent scientists of that time, and was allowed to use their libraries. The former, who had many duties to perform, soon asked Linnæus to give for him the public lectures in botany. The income from these gave Linnæus means to support himself and linked him closer to his favorite study. He became acquainted with practically all the plants of the gardens and fields of the whole region around Upsala and learned all the scientific names given in the books at his disposal.

The latter was not an easy matter, when we take into consideration the form of scientific names at that period. For example, the most approved name of the common blue-grass that adorns our lawns was: "*Gramen pratense paniculatum majus, latiore folio, Poa Theophrasti.*" Other names of the same grass were: "*Gramen vulgo cognitum,*" "*Gramen pratense majus vulgatius*" and "*Gramen alterum et vulgare.*" In the first publication by Linnæus it appears as "*Poa spiculis ovatis compressis muticis.*" I think that Linnæus and his contemporaries had much more cause than we to exclaim: "Those horrible Latin names!" To us the same plant is known as *Poa pratensis* L., the name adopted by Linnæus in his "Species Plantarum."

The lectures given by Linnæus for Professor Rudbeck became very popular. This was especially the case after his return from his Lapland journey. Some persons, especially Dr. Nils Rosen, became jealous of his success and induced the university faculty to pass a resolution by which no one who had not taken the corresponding degree was permitted to give university lectures. Linnæus had not yet received his doctor's degree, and hence was debarred. As Holland was offering at that time excellent facilities both in medicine and in botany, and as living expenses were lower than elsewhere, Linnæus decided to visit that country and take his examinations there. He received his doctor's diploma at Harderwijk, and afterwards went to Leyden, where he became acquainted with three of the greatest botanists of the time, Boerhaave, Burmann and Gronovius. George Clifford, the wealthy burgomaster of Amsterdam and president of the East India Company, was a great lover of plants and had a splendid botanical garden at Hartecamp as well as a rich library and herbarium. On the recommendation of Boerhaave, Linnæus became Clifford's physician and curator of his collections and garden. Here he lived in luxury, beloved as a son.

Clifford furnished Linnæus with means to publish five of his first books, "Systema Naturæ," "Fundamenta Botanica," "Bibliotheca Botanica," "Genera Plantarum" and "Flora Lapponica," the manuscript of which he had brought with him from Sweden. In the first of these Linnæus presents his system of classification. He divides nature into three kingdoms, the mineral, vegetable and animal. In the vegetable kingdom he brings out an altogether new classification, based upon the sexual organs of plants. He divides the kingdom

into 24 classes, the first 23 containing the phanerogams and the last the cryptogams. In the first 11 classes are included plants which have from 1 to 12 free and practically equal stamens; in the 12th and 13th, plants with many stamens; in the 14th and 15th, plants with 4 and 6 stamens respectively, of which 2 are decidedly shorter; in the 16th, 17th and 18th classes the stamens are united by their filaments; in the 19th they are united by their anthers, and in the 20th they are adnate to the pistil; in the 21st and 22d the flowers are unisexual, *i. e.*, the stamens and pistils are in different flowers, on the same individual in the 21st and on different individuals in the 22d; and the plants of the 23d class have both unisexual and bisexual flowers. The classes were divided into orders. In the first 13 classes the orders were determined by the number of the pistils, in the 14th and 15th by the fruit, and in the 16th and 18th and 20th to 23d by the number and distinctness or union of the stamens. The classification of the 19th class is too complex to enter into here. The 24th class was divided into 4 orders: Filices, Musci, Algæ and Fungi.

This system of classification is purely artificial. Linnæus himself regarded it only as temporary, and expected that it would soon be supplanted by a more rational one, based on natural relationship. The Linnæan system served its purpose, however. It became a means by which it was possible to tabulate every known genus of plants. Before this time there had been no systems at all, or such crude ones as we find even to-day in some popular flower-books, where the plants are classified by the color of their flowers. If the natural systems of DeCandolle, Bentham and Hooker, and Engler and Prantl are too complicated for popular books, why not go back to the simple system of Linnæus? It would at least give a good insight into the structure of the flower instead of the mere color.

In his "Genera Plantarum" Linnæus applied this system to all known genera of plants and gave each of them a concise and plain description.

Clifford had many American plants in his garden, but he sent Linnæus to England to visit Sir Hans Sloane, Professor Dillenius and Philip Miller, in order to secure American plants grown by them. Both Sloane and Dillenius treated Linnæus at first with coolness, because he "confounded" botany. On his farewell visit to Dillenius, Linnæus politely asked him what he meant by "confounding botany." Dillenius took from the library the first few pages of Linnæus's own "Genera Plantarum" and showed him where there was written at numerous places "NB." Dillenius stated that all the genera so marked were wrongly described. The first example he pointed out, if I am not mistaken, was *Canna*, placed by Linnæus in his first class, which contains plants with but one stamen. Botanists before this time had described it as having three stamens. To settle the dispute they went out into the garden and the living plant showed that Linnæus was correct. Dillenius then retained Linnæus for several days and found that the older botanists in most cases were at fault and the young Swede correct. From being an opponent, he became a friend of Linnæus and let him have all the plants he wanted.

After his return to Holland Linnæus continued his work in Clifford's garden with renewed zeal, and completed his "Hortus Cliffortianus," a large folio, in which are enumerated and described all the plants found in Clifford's collections, together with synonyms and citations of nearly all botanical works then in existence. In preparing this work he became thoroughly acquainted with almost all the literature re-

ferring to American botany, such as Morison's "Plantarum Historia," Plukenett's "Almagestrum Botanicum" and "Phytographia," Petiver's "Gazophylacium," Sloane's "Jamaica," Plumier's "Plantarum Americanarum Genera," "Plantarum Americanarum Fasciculus Primus" and "Filicetum Americanum," Catesby's "Historia Naturalis," and, later, Cornuti's "Canadensium Plantarum Historia."

After completing the "Hortus Cliffortianus," Linnæus returned to Leyden, where he spent some time helping Gronovius with the editing of his "Flora Virginica," based on a large collection of plants collected by Clayton. Here again he came in contact with American plants.

Linnæus then returned to Sweden and became a practising physician. He was soon appointed professor of medicine at Upsala, but by common agreement he exchanged chairs with Rosen, who held the professorship of botany. He now began work upon the most important book of his life, his "Species Plantarum." In this he tried to include a short description of every known species of plant, together with the most important synonyms and citations. In this book the Linnæan binomial system of nomenclature was used for the first time. Linnæus was not the first to give plants names; nor was he the first to name genera. Many Latin plant-names had come down from antiquity, while others had been proposed by his predecessors. Men like Tournefort and Micheli had in some cases clearer ideas of genera than Linnæus himself. Neither was Linnæus the first one to use binomials. In Cornuti's work on Canadian plants, for example, we find almost as many binomials as polynomials; but it is doubtful if Linnæus had seen Cornuti's book when he first wrote his "Species Plantarum." He does not cite it in the first edition, but does so in the second. Linnæus was, however, the first one to use binomials systematically and consistently. Before his time botanists had recognized genera and applied to them Latin nouns as names. In order to designate species, they added to these nouns adjective descriptive phrases. These consisted sometimes of a single adjective, as in *Quercus alba,* the white oak, but more often of a long string of adjectives and adjective modifiers, as in the case of the blue-grass mentioned above. The specific name had hitherto been merely a description modifying the generic name; from this time it became really a name, although a single adjective in form. An illustration of the pre-Linnæan form of plant-names might be had if, instead of "Grace Darling," one should say, "Mr. Darling's beautiful, slender, graceful, blue-eyed girl with long golden curls and rosy cheeks." "Grace" is just as descriptive of the girl as this whole string of adjectives. It may be that "Grace" is not always applicable to the person to whom the name is applied; but this is also often the case with many specific plant-names. *Asclepias syriaca* and *Rumex Britannica* are American plants, and *Rubus deliciosus* is one of the least delicious of the raspberry tribe. This invention and strict application of binomial names could not but cause a revolution in botany. Since the appearance of "Species Plantarum" in 1753 it has been possible to pigeonhole not only genera, but also species of plants.

Before this useful book was printed, Linnæus had become better acquainted with North American plants, and in another way. Baron Bjelke, the vice-president of the Court of Appeals of Finland, had proposed to the Royal Academy of Sciences at Stockholm to send an able man to Iceland and Siberia, countries partly in the same latitude as Sweden, "to make observations and such collections of seeds and plants as

would improve the Swedish husbandry, gardening, manufactures, arts and sciences." Dr. Linnæus suggested North America instead, and recommended one of his pupils, Professor Pehr Kalm, of Abo, for the proposed expedition. Kalm spent two years in North America, traveling through Pennsylvania, New Jersey, New York and Canada, and making large collections of seeds and plants, which were preserved as living or dried specimens or as alcoholic material. During his stay at Raccoon, New Jersey, he discovered our mountain laurel. The Swedes of Raccoon called it spoon-tree, because the Indians made spoons from its hard wood. Kalm adds in his journal about this tree: "The English call this tree a Laurel, because its leaves resemble those of the *Laurocerasus*. Linnæus, conformably to the peculiar friendship and goodness which he has honored me with, has pleased to call this tree *Kalmia foliis ovatis, corymbis terminalibus*, or *Kalmia latifolia*." Here Linnæus himself gave an illustration of both the pre-Linnæan and the post-Linnæan nomenclature. Kalm became acquainted with several of the naturalists of this country, C. Colden and his daughter Jane, Bartram and Clayton, and through Kalm a correspondence was established between them and Linnæus. Linnæus also corresponded with John Ellis, who resided in the West Indies, and Dr. Gardiner, who botanized in Carolina and Florida. Later he bought a set of plants collected by Patrick Browne in Jamaica, and received a part of the collections made by Jacquin in the West Indies.

When the second edition of the "Species Plantarum" appeared, in 1762, Linnæus knew and had described nearly 1,000 plants indigenous to the United States and Canada. Besides these, he described about 1,000 more, natives of the West Indies, Mexico and Central America, and 400 or 500 South American plants. His knowledge of American plants was small compared with what he knew of plants of the old world. "Codex Linnæanus," which enumerates all plants named by Linnæus, contains not fewer than 8,551 species.

Linnæus died January 10, 1778, honored and esteemed by all. Some of his work will doubtless live as long as botany is studied by man.

We see from the preceding account that we may consider Linnæus one of our American botanists. Even the little plant which Gronovius dedicated to the Father of Botany, the twin-flower of our woods, with its exquisite perfume and its dainty pink flowers, belongs to a genus essentially North American. The genus *Linnæa* contains four forms, all closely related. One of these, the original *Linnæa borealis*, is confined to the mountain regions of northern and central Europe. Linnæus discovered it on his Lapland journey and it was then considered a very rare plant. Now it seems to be more widely distributed than it was at the time of Linnæus. Perhaps it is of American origin and has become modified since it transplanted itself on the other side of the ocean. The other three forms are North American. *Linnæa americana* Forbes, which has usually been confounded with its European cousin, is common in the woods from Labrador to Alaska, and extends in the Rocky Mountains as far south as New Mexico. *L. longiflora* (Torr.) Howell, is found in the mountains from northern California to Alaska. The fourth form is, as far as I know, undescribed and unnamed. It is with great pleasure that I here propose the following name and description for this species:

LINNÆA SERPYLLIFOLIA sp. nov.[2]

Apparently the same plant has also been

[2] The description has been published in the *Bulletin of the New York Botanical Garden*.

collected on the island of Sachalin by F. Schmidt, but his specimens lack flowers.

P. A. RYDBERG

NEW YORK BOTANICAL GARDEN

## SCIENTIFIC BOOKS

*An Investigation of Evolution in Chrysomelid Beetles of the Genus Leptinotarsa.* By WILLIAM LAWRENCE TOWER. Washington, D. C., Carnegie Institution.

It has been an obvious criticism of many of the recent experimental and statistical investigations of matters connected with evolution that they were entirely too narrow in their scope. Even the famous studies of the evening primroses, by de Vries, suffered from the fact that their author did not really know as much about the species of *Œnothera* as was desirable, and was even ignorant of the original habitat of the species giving rise to so many remarkable mutations. The de Vriesian studies attracted so much attention that it was not long before many skilled botanists were hot on the trail of the missing data, and to-day the whole subject is on a very much better footing.

Professor Tower, in his work on the Colorado potato beetle and its allies, has not depended upon results obtained in the laboratory alone, but has undertaken a comprehensive study of the whole of the genus *Leptinotarsa,* and even of the related genera, in the field. He has compiled all the information extant in the literature of the subject, and has made repeated trips to Mexico and elsewhere to collect and study the beetles in their native habitats. He has found Mexico to contain a large number of species of *Leptinotarsa,* having characteristic habitats and habits, all of which he has described, with photographic illustrations. Southern Mexico, it is concluded, is the center of origin of *Leptinotarsa,* and consequently the Mecca of whoever would seek to unravel the secrets of its evolution.

It is not possible, of course, to give a summary of these ecological investigations in a review, but as an example we may quote from some of the remarks on *Leptinotarsa undecimlineata:*

An instructive illustration of the manner in which the dispersion of this beetle takes place was afforded by the recent building of a railroad through a perfectly flat, frequently flooded savanna near Tierra Blanca. The food plant grows generally over the savanna, but the beetle is entirely absent excepting at a few points along the road where the work of constructing ditches to keep the roadbed intact has created new localities with favorable conditions for their existence. Over a distance of about 18 kilometers there are now located flourishing colonies at each place where the work of the railroad builders has made existence possible, while on the unmodified savanna I have not been able to locate a single colony, and doubt if there are any. In this instance the advance into a new area has occupied two years and has been rapid. That transportation [by human means] did not bring about the starting of these colonies is certain, as the work of railroad construction was entirely suspended during the rainy season, when the beetles are active and dispersion takes place. It is perfectly clear that in this case the distribution was brought about by some few individuals from a colony happening by chance to discover the newly created habitat, proper for æstivation and for the breeding of the next generation. In each generation many will perish by not being able to reach the proper habitat after once having abandoned the parent colony, but the fact remains that some do discover proper habitats, and when such are found new colonies are established. . . . It is not necessary that the soil should be of a special chemical composition or temperature and rainfall of special amounts, but it is essential that during pupation and æstivation the beetle shall not be subjected to excessive desiccation or moisture, and that the soil shall be porous enough to admit of an abundant supply of air.

This, indeed, is real biology; and how different from some ecological writings we have seen!

When we come to the potato beetle, *L. decemlineata,* the discussion is most comprehensive. The most interesting fact brought out is the retreat of *L. juncta,* of the southern states and Atlantic seaboard, before the invading hordes of *decemlineata.* Now these two species have *different food plants,* and so apparently should not compete! It appears, however, that they freely cross, and

Concerning this crossing in nature and its effect upon *juncta* I shall have more to say in a later paper. The full explanation of the extinction of *juncta* is to be found in the fact that the two species cross freely in nature, and that this natural crossing has resulted in a most interesting and peculiar case of prepotency in one species and of submergence in the other.

Chapter II., on Variation in *Leptinotarsa,* gives us a detailed account of the variation, not merely of the adults, but also of the early stages. Schemes are invented for tabulating the different kinds of variation, and abundant statistics are offered. There is a most interesting section on "Place Variation," a term used to signify "the variation in any given species in the same locality from generation to generation, or from season to season, or year to year." Professor Tower says:

As far as I am able to determine from observations and experiment, place variations result in no permanent modifications, nor do the changes seem to be inherited. . . . This place variation must necessarily be a troublesome factor in the study by biometric methods of evolution, geographical variation or selection. In my own work it has been the rock upon which many cherished schemes have been wrecked, and I suspect it has not yet completed its destructive work. If one would study any of the broader problems of evolution by biometric methods he must first of all determine whether in the material chosen for study this phenomenon exists, and if it is found, too great care or too long a time can not be spent in the elimination of this factor. At present I know of but one method of doing this—that is, by collecting data and material over a sufficiently long period to determine the range of this form of variability. Unhappily this demands time, patience and often funds which the investigator will not or can not afford. The failure to take into consideration this place variation vitiates the validity of a large part of the biometric work that has been done, and there is no reason to think that it will be otherwise in the future.

It appears from the tables given, that there was usually an oscillation, *occupying about four generations,* from one extreme to the other. This oscillation even occurred in a laboratory experiment, as shown in *A,* Plate 26. Any one observing the changes through four generations only might consider that he had a beautiful case of progressive evolution, when, in the fifth, he would be again at the starting point! It is certainly conceivable, and if true of extraordinary interest, that this phenomenon is not *wholly* due to external causes, but is in part the outcome of a rhythmic pulsation of life, as it were, analogous to that which produces the well-known phenomenon of alternation of generations.

Professor Tower sums up his views on place variation under four heads, the fourth deserving to be quoted in italics.

*In place variation, whenever there occurs an extreme oscillation of the population there is an accompanying production of an unusually large percentage of extreme variations or mutants.*

This he observed in nature, and also under experimental conditions. The general fact has been known or suspected for many years—see, for instance, the variable Virginia colony of *Helix nemoralis,* and other like cases—but Professor Tower has planted what was somewhat of a "castle in the air," firmly upon the ground.

In the laboratory experiments it was found that mere selection of the extremes of normal variation (say light or dark) did not affect the type, the polygons made from the offspring of light or dark beetles being practically coincident. When, however, strong environmental stimuli (say dryness and moisture) were applied, it was found that marked "place variation" occurred, resulting in distinct polygons for the lots so treated, the two not even closely approaching, much less overlapping. By the application of suitable conditions, together with rigid selection, it was easily possible to produce two very distinct races: not, however, much exceeding the extremes of normal variation for the species. Nevertheless, when these things were abated, the beetles soon went back to the normal condition of the species, no trace of the past excentricity remaining.

I have said that no trace of the excentricity remained, but while this was exactly true for the bulk of the material, *while the excentricity*

*was at its greatest, several mutations were produced.*

Thus there were produced from the light (dry) series examples of *pallida* and *defectopunctata,* and from the dark (wet), specimens of *melanicum.* The most numerous of these was the *pallida,* a form with the usual markings, but the ground color exceedingly pale. This *pallida* occurred also out of doors in the potato fields, but so rarely that Professor Tower is convinced that it is virtually impossible for it to establish itself. When isolated and inbred, however, it comes perfectly true, and in this way a very numerous colony of pure *pallida* was obtained. Some of these were bred in company with typical *decemlineata,* and it was found that the normal crossings (*i. e.,* of like beetles) were to the abnormal as 7 to 1. On account of this, the *pallida* were not swamped, but continued to increase when both were transferred to natural conditions in the grounds of the University of Chicago. Professor Tower was very anxious to allow the *pallida* to spread widely over the country, and see what would happen; but the injurious character of the insect made this impossible and so the colony was destroyed.

When bred with *decemlineata, pallida* gave the normal Mendelian results, with *decemlineata* dominant.

*Melanicum,* the dark variety, is in some ways even more interesting.

It appears to be very distinct, and is crossed with difficulty with *decemlineata;* when a successful cross is obtained, the results are Mendelian.

> It is, moreover, ill adapted to the habitat of *decemlineata,* into which it must be born, as it is apparently able to live or reproduce only in a high percentage of humidity. My experience with them is that only the above condition can be used for their propagation in experiment, and there is every reason to believe they would require a like condition in nature.

This appears to be very suggestive of a method of origin of a new species. It is shown that the mutation *melanicum* arises from *decemlineata* when the latter is subjected to conditions of moisture, and that it requires excessive moisture. Let *decemlineata* reach a too moist region, and produce a few *melanicum;* will not these proceed still farther into the humid area, and there multiply in comfort and isolation, forming a veritable new species? This will be facilitated by the difficulty of crossing with the parent form.

Chapter IV., on habits and instincts in *Leptinotarsa,* is especially important for the understanding of the evolution of these beetles. It was ascertained that selective mating existed in respect to size, being due to the inability of abnormal individuals to properly perform the sexual act.

> We do not ordinarily realize how narrow are the limits within which successful copulation can take place in insects, or how slight a variation is sufficient to prevent the performance of the sexual act with such completeness as to insure the leaving of progeny.

Nevertheless, as was to be expected, there was no trace of psychological selection.

The above account does not in any sense do justice to this remarkable work. There is much in it to which no reference has been made; and I do not attempt a summary of Professor Tower's closing chapter, which should be read in its entirety, and is too long to republish here. There are places where one does not feel quite sure that the facts justify the conclusions reached, and here and there we find inconsistencies. We also regret the absence of information in several places; thus we are told that the conditions at Cabin John Bridge were such as to produce many mutations, but just what those conditions were does not appear. We also have names for some new species and varieties, without any descriptions. These things, as I learn from a letter received from the author, will be remedied in a subsequent publication; the present volume (though of 320 pages) being merely preliminary, and representing a mere fraction of the whole material gathered.

A rumor has reached me that there is some question about the continuance of the grants upon which Professor Tower's work depends. This work is necessarily somewhat expensive; but if, in some way or another, this country

can not find for Professor Tower all the money and leisure it requires, for as many years as he is willing to continue his labors, it will be disgraceful beyond measure. One of the truest tests of the intellectual status of a country is found in its ability to quickly realize the importance of a work of the first class. Since this book came out, I have asked a number of naturalists whether they had read it; and have so far failed to find one who has given it more than superficial attention. Its bulk and the fact that it is ostensibly devoted to a very limited subject—a single genus of beetles—together with its limited circulation, resulting from the mode of publication, have combined to prevent it from receiving due attention, at least in certain quarters where it should have been hailed with delight. If the present notice will serve to show that it is of the first importance to every biologist, whatever his specialty, that will be ample excuse for its length.

T. D. A. Cockerell

## *SOCIETIES AND ACADEMIES*

### THE AMERICAN SCHOOL HYGIENE ASSOCIATION

The American School Hygiene Association held its meeting for organization in Washington City, May 6 and 7, 1907, at the Hotel Shoreham. The following program was presented:

*Monday, May 6*, 3:00 P.M.

Report of Committee on Organization, Arthur T. Cabot, M.D., chairman, fellow Harvard University, Boston.

"Physiological Age and its Influence on School Progress," C. Ward Crampton, M.D., assistant director of physical training, New York City Public Schools.

*Monday*, 8:00 P.M.

"Medical Inspection of Schools in Massachusetts," Hon. George Martin, LL.D., secretary of the Massachusetts State Board of Health.

"Medical Examination in New York City Public Schools," John J. Cronin, M.D., assistant chief medical inspector, Board of Health, New York City.

Discussion opened by Thomas Darlington, M.D., commissioner of health, New York City.

*Tuesday, May 7*, 3:00 P.M.

"The Requirements of Proper School Furniture," Robert W. Lovett, M.D, Harvard Medical School.

(These papers are to be published by the association.)

*Business Meeting.*

A constitution and certain resolutions were adopted, of which a few extracts are here given.

EXTRACTS FROM THE CONSTITUTION

Article II. The objects of this Association shall be: (*a*) To stimulate research and to promote discussion of the problems of school hygiene. (*b*) To take an active part in movements wisely aiming to improve the hygienic conditions surrounding children during school life.

Article X. The Council shall be empowered to publish its proceedings in a volume or journal, together with special reports, bibliographies and articles that may aid in the objects of this Association.

Article XIV. Any person may become an active member of this Association upon recommendation of two members, election by the council and the payment of one year's dues.

Article XV. Honorary members shall be nominated by the Council and shall be elected by a two-thirds vote of the members present at the annual meeting.

Article XVI. The Association shall hold an annual meeting and such other meetings as they shall from time to time determine.

Article XIX. Funds shall be raised by annual dues of three dollars from each active member, and in such manner as shall be approved by the Council.

RESOLUTIONS ADOPTED AT THE FIRST MEETING

Whereas, The maintenance and development of the health and vigor of school children is a matter of paramount importance, and

Whereas, Experience in all great cities has shown the importance of health inspection; be it

*Resolved*, That in every city and town adequate provision should be made both for sanitary inspection of schools and for medical inspection, the latter to include not only inspection for contagious diseases, but also of eyes, ears, teeth, throat and nose and of general physical condition.

Whereas, The improvement in the health and of the hygienic conditions surrounding school children depends largely upon the intelligent cooperation, the competency, the interest and the faithfulness of teachers and principals in matters of hygienic importance; therefore, be it

*Resolved*, That all schools having courses for the training of teachers should give instruction in (*a*) personal and school hygiene and (*b*) the principles and practise of physical training, and that each of these subjects should be given as much time as the major subjects in the course.

*Resolved*, That examinations for licenses to teach should include questions upon these subjects, and that the answers to such questions should be given equal weight with the answers to questions upon any other subjects.

The officers elected for the ensuing year were:

*Hon. President*—Theodore Roosevelt.

*President*—Dr. Henry P. Walcott.

*Vice-President*—Dr. Arthur T. Cabot.

*Secretary-Treasurer*—Dr. Thomas A. Storey.

*Members of Council for One Year*—John A. Bergström, Ph.D., Elmer E. Brown, Ph.D., W. H. Burnham, Ph.D., John J. Cronin, M.D., Abraham Jacobi, M.D., LL.D., W. H. Maxwell, A.M., LL.D., John H. Musser, M.D., John Ridlon, M.D., Myles Standish, M.D., H. P. Walcott, A.B., M.D.

*Members of Council for Two Years*—Walter E. Fernald, M.D., C. Harrington, A.B., M.D., C. N. Kendall, A.M., Geo. H. Martin, LL.D., J. H. McCullum, M.D., J. H. McCurdy, M.D., C. A. Moore, Edw. L. Stevens, L.H.D., J. J. Storrow, Edw. Lee Thorndike, Ph.D.

*Members of Council for Three Years*—Champe S. Andrews, Nicholas M. Butler, A.M., LL.D., Litt.D., Arthur T. Cabot, M.D., Frederick Forchheimer, M.D., W. E. Fischel, M.D., L. H. Gulick, M.D., M.P.E., C. W. Hetherington, Ph.D., Geo. L. Meylan, A.M., M.D., Thos. A. Storey, Ph.D., M.D., William H. Welch, M.D., LL.D.

Henry P. Bowditch, M.D., professor of physiology in the Harvard Medical School was unanimously elected first honorary member of the association. THOMAS A. STOREY,
*Secretary*

COLLEGE OF THE CITY OF NEW YORK

## *DISCUSSION AND CORRESPONDENCE*

### "POPULAR" SCIENCE

IN a recent communication,[1] Mrs. Franklin enters a timely protest against the pseudo-science of the popular magazines. Every investigator of color vision must agree with Mrs. Franklin that Dr. Ayers's conception of color-blindness—as presented in the April *Century* —"belongs to the class of the antiquated and the non-scientific." And a more recent paper in the same magazine by Professor Stratton, of the Johns Hopkins University, is equally defective and misleading.

[1] SCIENCE, N. S., XXV., May 10, 1907, p. 746.

Under the title "Railway Disasters at Night" Professor Stratton discusses a topic which has aroused wide-spread popular interest. The author describes various real and fictitious defects of color vision, and from this sweeping condemnation of the color sense he infers that the "space sense" is more worthy of being entrusted with the responsibility of an accurate discrimination of signals. Accordingly, he recommends the disuse of the present system of railway signaling by means of colored lights, and advocates the substitution of illuminated semaphores which shall appeal to the "space sense." The author's argument centers around the problem of color vision, and it is chiefly to his discussion of this topic that exception must be taken. Most of the errors contained in the paper must be ignored in this brief communication; but I shall venture to call attention to two or three points which may have escaped the notice of the casual reader.

Among the reasons assigned by Professor Stratton for the alleged failure of colored signals is the following startling disclosure:

> The limitations of the normal eye are, however, not yet fully told. Even when it looks with fair accuracy at them, it is always at a disadvantage with regard to colors at night. The eye, grown accustomed to darkness, becomes exceedingly sensitive to faint lights, but it no longer detects their proper colors: "in the dusk all cats are gray." At nightfall a strange kind of second-sight comes in to supplement the vision of common day, now baffled; but this owl-sight of the human eye is able to catch bare light and shade and form, and is blind to the hue of things.

Now if the human retina really were color-blind at night, as Professor Stratton believes, he would undoubtedly have an argument against the present system of night signals; but he would be confronted by the difficulty of explaining how a night express ever reaches its destination in safety—since its safety

would depend upon the engineer's ability to distinguish between indistinguishable signals. As a matter of fact, the reverse of Professor Stratton's statement is true. Instead of being totally, or even partially, color-blind, "the normal eye, grown accustomed to darkness," is much more sensitive to color than is the retina in daylight vision. Indeed, the increased color-sensitivity of the dark-adapted retina is so striking and so well-known that it has in several instances been made the object of special investigation. And the investigators who have made quantitative determinations of this hyperesthesia to color agree that it amounts to, at least, *two hundredfold.*

Professor Stratton believes that another reason for the misinterpretation of colored signals is to be found in the fact that one "is incapable of seeing correctly the color of objects caught out of the corner of the eye." He represents the engineer as being so occupied with his engine and his time-piece, that he does not even see his signals until he is upon them. "The color of a signal must be caught in its flight to one side" while the engine rushes past in mad career. It seems unnecessary to discuss the question as to whether or not Professor Stratton's dramatic description represents the actual procedure adopted by the engineer in the reading of his signals; but it may be remarked that if engineers really do attempt to interpret signals under the conditions described by the author, the semaphore device which he advocates would prove to be even more defective than the despised system of colored lights. For while it is true that the outlying regions of the retinal surface are relatively insensitive to color, it is also true that these peripheral regions are even less capable of discriminating between spatial forms.

The author errs again in his discussion of the status of "color weakness." It is popularly supposed that there exists a group of individuals who are "weak in their color sense, but by no means color-blind." Professor Stratton promulgates this erroneous conception, notwithstanding the fact that in an examination of several thousand cases of "color weakness" Professor Nagel, of Berlin, found not a single instance of the defect that did not turn out, on closer investigation, to be a familiar case of color-blindness.

Professor Stratton omits to mention that the illuminated semaphore which he recommends is an antiquated expedient. It represents an earlier stage in the evolution of the present system of signaling; it was introduced into the railway service many years ago, but, for reasons which need not be discussed here, it never came into general use. Its failure and ultimate supplanting by colored lights are now a matter of history.

J. W. Baird

University of Illinois

### THE DEFINITION OF RESPIRATION

To the Editor of Science: In the article "On the Teaching of the Subject of Respiration" in Science for April 19 it is stated that "the confusion of words is inconvenient enough, but there is back of it a confusion of ideas which is more serious and by which the teaching of the subject is more or less impaired." That this is true there is abundant evidence, while a very superficial glance over the recent literature of the subject shows where the trouble lies. If only one authority were consulted little difficulty would result, for the differences are concerned with words rather than with ideas; each book is clear enough if taken by itself; yet the number of definitions of respiration that are available to the student can lead to nothing but confusion. A few brief quotations will illustrate this. Barnes[1] speaks of "another false conception. . . . One often finds respiration described as a gaseous exchange—the taking up of oxygen and giving off of carbon dioxid—a trade between the atmosphere and the body." More recently Loeb[2] has stated, "By respiration we mean the taking up of oxygen and the giving off of $CO_2$. We shall see later that the latter process can exist independently of the taking up of oxy-

[1] "The Theory of Respiration," Science, February 17, 1905.

[2] "The Dynamics of Living Matter," 1906.

gen." Mathews[3] says that "Respiration is in fact the dissociation of water with the liberation of hydrogen." In recent school textbooks there are also wide differences. "The entire process of respiration consists simply of an exchange of gases through a membrane" (Linville and Kelly[4]). "This oxygen consumption is the *respiration* of plants" (Bergen and Davis[5]). "The process by which oxygen is taken into the body and carbon dioxide is given off is *respiration*" (Atkinson[6]). "The escape of carbon dioxide, which follows the taking in of oxygen, is the superficial indication that the very important process called respiration is going on . . . just what happens in respiration is very uncertain, but it involves a series of changes in the living substance itself" (Coulter[7]). These fragmentary quotations sufficiently demonstrate the different points of view. Hough and Sedgwick,[8] in a book which will help to raise the quality of physiology-teaching in our schools, have it that "breathing is not the fundamental act of respiration; . . . this cell breathing is the essential act of respiration, for respiration is only another name for the oxidative processes of the living body"; but later we find, "The consumption of oxygen and the production of carbon dioxide thus involve an interchange of these gases between the blood and the tissues (internal respiration) on the one hand, and between the blood and the air in the lungs (external respiration) on the other." This latter statement is similar to what may be found in most of our school physiologies, and for that reason alone would best define respiration as understood by the great majority of school and college students.

On the whole this conception seems to be the right one. It has the endorsement of the great majority of writers on physiology, while custom, the dictionary and the etymology of the word strongly support it. The present confusion is largely due to the effort to change the meaning of a word that has long been in general use, an effort that as yet seems to be confined to a few plant physiologists.

It is very desirable that the common characteristics of living organisms should not be lost sight of and that botanical physiology should not have a different terminology from zoological. It is also desirable that the language spoken in the laboratory should not differ from that which can be properly used outside. Dr. Shaw says, "To define respiration then as a gaseous exchange is to turn away from the all-important process." We can not agree with this "telling objection." As long as there is such a thing as this peculiar gas exchange some word will be needed for it; "respiration" is evidently that word and should no more turn us away from the vital process than "excretion," "alimentation" or other words necessary to describe the superficial phenomena. While respiration is not fundamental it is by no means unessential; from many points of view it is more important than the disruptive processes within the cell. In the study of anatomy, of adaptations, of habits, and of ecology in its widest sense the nature of the gas exchange and the means by which it is accomplished become of dominant importance.

If the word respiration is to be shifted to the energy-releasing process within the cell some new word will be needed to cover those processes now understood under that term. It would be interesting to know if the meanings of the related words "inspire" and "expire" are to be changed. Also, what becomes of the "organs of respiration"? Do they disappear? Or are we to add to lungs, gills, stomata, etc., such structures as root hairs, kidneys, the intestine or other organs that may be concerned with those exchanges between the organism and its surroundings by which the disruptive process is maintained?

"Respiration," as it has long been understood, is a useful, indeed a necessary, term; the new conception of the energy-releasing processes within the cell deserves to be dignified by a new word. The confusion that once

[3] *Biol. Bull.*, Vol. VIII., May 6, 1905.

[4] "Text-book in General Zoology," 1906.

[5] "Principles of Botany," 1906.

[6] "College Botany," 1905.

[7] "A Text-book of Botany," 1906.

[8] "The Human Mechanism," 1906.

surrounded the conception of "carbon assimilation," or whatever else it was called, has been wonderfully cleared by the adoption of "photosynthesis." It is to be believed that a similar clarifying process would take place, and the thanks of teachers of plant physiology would again be earned by Dr. Barnes, if the word "energesis" could be generally adopted.

W. E. Praeger

Kalamazoo College

### VOLCANIC ACTIVITY IN ALASKA

To the Editor of Science: Mr. Arthur P. Porter, civil engineer and graduate of the Massachusetts Institute of Technology, writing from Elliott Creek, Alaska, under date of May 24, 1907, communicates the following interesting observations:

On and about April 5, several mountains of the Wrangell range in Alaska were active volcanically, sending up great clouds of steam and causing a flood in the Kotsina River that, on April 6, came down past our camp at the mouth of the Kotsina, cut us off from our supply train and prevented our going up the Kotsina on the ice.

To go more into detail, the first we heard about it was on April 1, when we were mushing down the Tonsino River. We stopped for dinner at the camp of some freighters hauling in supplies for the Hubbard-Elliott mine; and Mr. Hubbard said that they could plainly see the smoke (?) and steam rising from Mt. Wrangell. That afternoon and the following day, as we proceeded down the Tonsino and then down the Copper River, we caught occasional distant views of the mountains, but I noted nothing remarkable. (A photograph taken April 2 shows the mountains clear.) On April 5 and 6 we saw great white clouds which always rolled away from the mountains, yet never left them clear; and with the field glasses steam was seen issuing from the sides of the mountains below the tops. We were at the mouth of the Kotsina, about forty miles from the mountains, and could not positively identify the peaks. Apparently, however, Mts. Wrangell, Blackburn and Sanford were all sending up steam.

The next day, April 6, a sudden flood came down the Kotsina on top of the ice and underneath it. There had been no warm weather and no rain (28° below zero instead). The flood lasted two days and then went down. The enclosed photograph shows the head of the flood advancing down the river and spreading over the snow as it came. I stepped on an ice hummock to take the picture; and by the time I could focus my camera, the flood had passed me on both sides and nearly cut me off. The toe of the flood advanced at the rate of fifty feet a minute, actual timing, eating its way through the snow as if the water were warm.

May 28, the mountains seem to be steaming again (Mt. Drum or Mt. Sanford), and others noted the same two days ago.

W. O. Crosby

Massachusetts Institute of Technology

### RANA PIPIENS

To the Editor of Science: While I was in charge of the neurological work at the University of Chicago, there were published from the laboratory eight papers dealing with the anatomy of the nervous system of the leopard frog. In these publications the species was designated as *Rana virescens brachycephala* (Cope). I have recently learned through the kindness of Dr. Leonhard Stejneger, of the National Museum, that this name is no longer used, and that the correct designation for the leopard frog is *Rana pipiens* (Schreber), as given by Jordan, "Manual of the Vertebrate Animals of the Northern United States," and adopted by Holmes, "Biology of the Frog," 1906, and Miss Dickerson, "The Frog Book," 1906.

In my further studies on the nervous system of the leopard frog, the species will be designated, therefore, as *Rana pipiens*. In view of the fact that there are several investigations on this species still to be published, I take this opportunity of calling attention to the change in name, first, because those of us who are not specially concerned with taxonomy are apt to be confused by such changes, and second, because I wish to emphasize the fact that these later studies will apply to the same species as that used in the earlier investigations.

Henry H. Donaldson

Wistar Institute of Anatomy

## SPECIAL ARTICLES

### ANOTHER WORD ABOUT THE NORTHERN BOUNDARY OF MINNESOTA

IN examining a series of old maps of the "Hill records" of the Minnesota Historical Society, new light has been thrown on the northern boundary of Minnesota, as it was first proposed by the commissioners of the United States and Great Britain.

The first use of the term "most northwestern point of the Lake of the Woods" was in the proposed articles of a treaty of peace between the United States and Great Britain, November 25, 1782. The definition and the proposition came from Mr. Oswald, the British commissioner, who was in Paris in conference with the American Plenipotentiaries. It was adopted only five days later in the provisional articles of peace as signed and finally approved by both governments. It is the conclusion of that part of the section which defines the boundary line from Lake Superior to the Lake of the Woods. Mr. A. J. Hill has exhaustively discussed the complicated question which was raised by the attempt to extend the boundary "thence on a due west course to the river Mississippi": this interesting and long-drawn discussion, with the various phases of diplomacy which the error in the treaty entailed, is published in the appendix of Vol. VII. of the Collections of the Minnesota Historical Society. Mr. Hill also gives the steps taken by the two governments to determine the exact location of that point, but records his belief that the place contemplated by the treaty of 1783 was at the outlet of the Lake of the Woods, that is, at Rat Portage. This belief he based on the shape of the lake as represented on the "Mitchell map" used by the joint commission when they drew up the terms of the treaty. The sagacity of this opinion is fully demonstrated by the designations on an English map which I have recently had the opportunity of examining, through the courtesy of Hon. N. P. Langford, president of the Historical Society. This map was published in London, in 1794, by Laurie and Whittle, 53 Fleet Street. Therefore its date was between the signing of the first treaty and the discovery of the fact that the Mississippi did not rise so far north as the Lake of the Woods. It was evidently an important map, covering a large area and extending from Spain westwardly to a meridian in the Pacific 25 degrees west from Cape Mendocino, and from the equator to Hudson's Bay. It has no individual title nor author's name. It seems to have come from an atlas, on the cover of which the date and the publisher's name are expressed. I have not seen the whole atlas, and these details are on the authority of Mr. Charles A. Heath, of Chicago, who owns the map.

I was at once struck by the fact that the international boundary, which is distinctly shown by a heavy red line, does not follow the route for canoes which was finally settled upon as the boundary. At Saganaga Lake it runs toward the northwestward instead of southwestward, thus passing to the north of Hunter's Island, following the course of drainage from Saganaga Lake. In order to take a canoe southwestward from Saganaga Lake it is necessary to make a short portage into Oak Lake, and thus to put the canoe into a different water-course. Dr. U. S. Grant has called attention to this departure from the real water-course and to the consequences resulting in loss of territory to the United States, in a paper published in the eighth volume of the Collections of the Historical Society. He has also mentioned several other instances of portaging from the direct and usual route to other waters lying to the south; and Dr. A. N. Winchell, in his article in Vol. VIII. of the same publication, has given the history of the negotiations which resulted in the present boundary line.

What is singular is, not that the red line of the map invariably follows the regular and continuous water-course after leaving Saganaga Lake, as far as to Rainy Lake, but that it strikes the north end of Rainy Lake, and thence passes to the north end of the Lake of the Woods, at the outlet of that lake. It thus puts within the territory of the United States the whole of Rainy Lake, and the most of the Lake of the Woods.

On comparing this map with other old maps that were gathered by the late A. J. Hill, it becomes apparent not only that there are two "water" routes all the way between Saganaga and Rainy Lakes, but also two water or canoe routes between Rainy Lake and Lake of the Woods. These two routes are shown, in whole or in part, by the following maps:

1743. *Carte de l'Amérique septentrionale pour servir à l'histoire de la Nouvelle France. Par N. B. [Bellin?], Ing. du Roy et Hydrog. de la Marine.* On this map, westward from Lake Superior, are three water routes, which, notwithstanding the incorrectness of the map, can be identified as well known hydrographic features. The most northern is that which starts from Thunder Bay, ascending the Kamanistigouia River, and may be known distinctively as the *Kamanistigouia route.* It is represented as a nearly straight water-course, of which the east end flows east and the west end west. It has three connections with the more southern route, all leading to Rainy Lake, but it continues on westward and joins a stream which is represented to flow into "Lac des Bois" from the north. The next southern route (the *international boundary*) divides at Saganaga Lake. The northern branch unites with a stream that leads to the northeast corner of Rainy Lake. The southern branch, running along the south side of Hunter's Island, continues to Rainy Lake, joining it from the east. The most southern of the main routes mentioned is that which leaves Lake Superior at its most western point and is evidently meant to be that by way of the St. Louis River. It unites with the international boundary route westward from Lake Saganaga, evidently by way of the Vermilion River. Westward from Rainy Lake are two water-courses, one passing northward into the Kamanistigonia route, and the other westward, by way of Rainy River, and joining Lake of the Woods near its middle, amongst islands, from the east. The southern portion of Lac des Bois, which receives several streams from the south, is very inconsequential. This portion was afterwards known as "Lake of the Sand Hills."

1755. *Partie de l'Amerique septentrionale qui comprend la Nouvelle France ou le Canada. Par le Sr. Robert de Vaugondy, Geog.* The only route westward from Saganaga Lake, shown on this map, runs north of Hunter's Island, the southwestern route, where the actual boundary runs, being discontinued after passing through two lakes. This northern water-course unites with the northwest side of Rainy Lake, apparently by way of the Seine River. The routes westward from Rainy Lake are (*a*) the Rainy River and (*b*) a river route which has a curious course, reaching "Lac des Bois" from the northeast, thus enclosing a large island between Rainy Lake and Lake of the Woods. This northern route is simplified in later maps.

1755. *Carte de l'Amerique septentrionale depuis le 28 Degré de latitude jusqu' au 72. Par M. Bellin, Ingenieur de la marine.* By this map there are two water routes westward from Lake Superior. The most northern is that which may be known as the *Kamanistigouia route,* starting from Thunder Bay. The other is the Pigeon River route which is now the international boundary. It is an interesting fact that at Saganaga Lake this southern route branches, one branch going to the north of Hunter's Island and joining the Kamanistigouia route at a lake some distance east of Rainy Lake, thence the united routes joining Rainy Lake at the east side. The southern branch, which became later the international boundary, joins Rainy Lake from the southeast. Westward from Rainy Lake there is shown but one route, plainly that of the Rainy River, though it is represented to unite with Lake of the Woods in the northern portion of that lake instead of in the southern.

1762. *Canada, Louisiane, Possessions Angl. Par le S. Robert de Vaugondy, Geog ord. du Roy,* etc. This map shows two through routes to Rainy Lake, of which the northern is that by the Kamanistigouia and enters that lake by the Seine River. The southern divides into two branches, of which the northern starts from Saganaga Lake and unites with the *Kamanistigouia* route at a lake east of Rainy Lake, and the southern continues through a

series of lakes, now the international boundary, to Rainy Lake. There is but one route westward from Rainy Lake to Lake of the Woods, that being by the Rainy River.

1776 (?). *An accurate map of Canada, with the adjacent countries, exhibiting the late seat of war between the English and French in those parts.* Univ. Mag. J. Hinton, Newgate Street. This English map was certainly made between the dates of the cession of Canada to England and the close of the Revolutionary war, although its exact date is not known. It shows two routes of water travel westward from Lake Superior. Of these the northern is that by way of the Kamanistigouia River, passing through "Long Lake" and "Flat Lake." The southern route is by way of the Pigeon River to Lake "Sesakinaga" at its north end, and from that lake northwestwardly, evidently along the north side of Hunter's Island.

1775. *North America, from the French of Mr. d'Anville, improved with the English surveys made since the Peace.* London. "Printed for Robert Sayer and J. Bennett, Map and Print sellers, No. 53 Fleet street, as the act directs 10 June 1775." This map shows three routes to Rainy Lake, viz.: (*a*) The Kamanistiquoia route, passing through the "Long Lakes" at some distance inland. (*b*) The international boundary route, passing through "Long Lakes" near Lake Superior, leading to Saganaga Lake and there dividing, like other maps, one branch going northwest and the other southwest. Of these the northern branch only reaches Rainy Lake, the other apparently being discontinued or blending into (*c*), the third main route, which follows the St. Louis River northwestwardly, uniting with the chain of lakes of the present international route. Westward from Rainy Lake only the route via Rainy River is shown.

1780 (?). *A chart of the interior part of North America, demonstrating the very great probability of an inland navigation from Hudson's bay to the west coast.* The date of this map is uncertain. It is very generalized and its only value in this connection is its naming the "Back Road" between Rainy Lake and Lake of the Woods. This name is applied to the only water course between those lakes but is a term which afterwards was given only to the more northern route of canoe travel between them.

1790. *A map showing the communication of the lakes and the rivers between Lake Superior and Slave Lake in North America. Gentleman's Magazine,* 1790. Plate 1. This generalized map is valuable in this connection only because it shows two conspicuous watercourses leading westward from Rainy Lake to Lake of the Woods. Eastward from Rainy Lake the single water route is that which leads to the "grand portage" from Pigeon River to Lake Superior.

1826. *Map of the Missouri and higher parts of the Mississippi, and of the elevated plain where the waters divide, which run eastward into the River St. Lawrence, northeast into Hudson's Bay, north-northwest into the frozen sea and south into the Gulf of Mexico; to which is added Mackenzie's track in 1789.* From Lake Superior westward is shown but one water route, which is apparently that of the international boundary, consisting of many small lakes and short streams between them, as far as Rainy Lake. But westward from Rainy Lake are two water routes, one plainly the Rainy River route joining Lake of the Woods from the southeast, and the other running directly from the northwest corner of Rainy Lake northwestwardly to Lake of the Woods, considerably shorter than the southern route.

[*Note.*—This is the map compiled by Gen. Collot to accompany his travels in North America, 1794–96. It was engraved in 1805 and the book printed, but not published till 1826.]

1830. *United States of America, compiled from the latest and best authorities,* by John Mellish. The route here represented is that of the international boundary, through Rainy Lake and to the northern end of Lake of the Woods, where the outflow is to Lake Winnipeg. But from the northwest corner of Rainy Lake another water-course is shown, entering Lake of the Woods from the east about mid-

way. The land thus surrounded by water is named *Maple Island*.

1860. *Map of the boundary line between British America and the United States*. Accompanying Hind's report on the Assiniboine and Saskatchewan Exploring Expedition. London Edition. This map shows excellently not only the international boundary route but also the more northern water route along which the body of water flows from Saganaga Lake to Rainy Lake, west from which the margin cuts it off.

1860. *Map of the country from Lake Superior to the Pacific Ocean*. Accompanying Hind's report on the Assiniboine and Saskatchewan Exploring Expedition. London Edition. While showing the same two routes as the last mentioned map, this shows the two routes that lead from Rainy Lake to Lake of the Woods.

Several later Canadian maps plainly delineate the routes of canoe travel between Lake Superior and Lake of the Woods, viz., Dawson's and the maps of the Geological Survey.

*Conclusions*. It is plain, therefore, that the proposition of the British commissioner (Oswald) was designed to carry the international boundary to the outlet of the Lake of the Woods and thence "westward to the Missisippi."

It is plain also that in London the British geographers so understood the terms of the treaty of 1789, and further that the line was to leave Lake Superior at "3 Rivers," *i. e.*, at the mouth of *Kamanistigouia River*.

It was then supposed, and is now demonstrated, that westward from Lake Saganaga, nearly all the way to Lake of the Woods, there are two canoe routes of travel which unite in the same waters only in passing through Rainy Lake, the northern route carrying the main water-flow eastward from Rainy Lake, and the southern one westward from that lake.

In order to reach the most northwestern point of the Lake of the Woods by the most direct route it would obviously be necessary to follow the more northern of these routes all the way to Rainy Lake and there depart from it, as shown by the map of Laurie and Whittle, of 1794, to take a shorter route northwestwardly to the northern part of Lake of the Woods.

It is also now plain that the provisional determination of the point of the most northwest angle was very carelessly and incorrectly done, and ought not to have been accepted by the United States.

When the Webster-Ashburton treaty of 1842 accepted that point, thus determined, and defined the boundary by specifying certain lakes through which the line should run, further uncertainty and controversy were cut off.

There was a constant tendency to shift the flexible boundary line farther and farther toward the south. This is probably attributable to the guidance of the Canadian *voyageurs*, who were the only men acquainted with the region and who were then British subjects.

In the removal of the boundary from the original route along the main water-course to its southern course, Dr. Grant has estimated the loss of land by the United States to be about 1,000 square miles, eastward from Rainy Lake.

Westward from Rainy Lake is an area of excellent agricultural land along both sides of the Rainy River, embraced within the limits of the glacial Lake Agassiz. If the original intent of the treaty of 1783 had finally become effective in the treaty of 1842, about 1,000 more square miles would have been embraced within the United States, the greater part of which is flat and arable at once on the removal of the forest.

Again, if the boundary had left Lake Superior at "3 Rivers," as indicated on the accompanying map of Laurie and Whittle, a still further large area, which may be estimated at 500 square miles, would have fallen to the United States.

Finally, it is plain that through the inadvertence of the American commissioners of 1842 about 2,500 square miles of land were yielded to the British commissioners, more than was contemplated by the original treaty —that, too, while they were very tenacious, in

following the instructions of the president, *not to grant any cession of land from the territory of the United States.*

The only comfort which can be derived from this *crying over spilt milk* is that relief which comes with a gush of tears, and from the satisfaction of remembering "what might have been." N. H. WINCHELL

MINNESOTA HISTORICAL SOCIETY,
May, 1907

REGENERATION AND THE QUESTION OF "SYMMETRY IN THE BIG CLAWS OF THE LOBSTER"

IN view of several recent articles[1] on the phenomena of symmetrical chelæ in the lobster it seems desirable to offer a few further considerations on the subject of the origin of such structures.

Let us briefly present the nature of the problem. It is a matter of common observation that in the adult lobster the "great" claws are almost invariably asymmetrical with reference to each other; the claw on one side of the body being a "nipper" and the other a "crusher." In a few cases, however, a variation from this normal asymmetry has been discovered, in which the claws instead of differing from each other are very much alike and symmetrical in form. These variations fall into two categories: First, those in which both claws are of the nipper type, and second, those in which the similar claws are both crushers. Two theories for the origin of these relations of symmetry have been presented—first, that they are predetermined in the egg, and second that they may arise through regenerative processes and consequently, are not of necessity wholly determined by congenital factors. Let us consider first the variations from normal asymmetry.

I. *Explanations for Abnormally Symmetrical Claws.*

(*a*) *Similar Nipper Claws.*—Until very recently in all the authentic cases of similar chelæ, the claws belonged to the first category of the nipper type. Out of over 2,400 lobsters[2] found only three had similar claws. In an examination of some 600 specimens as they came in from the traps at the Experiment Station of the Rhode Island Commission of Inland Fisheries the writer[3] found only one lobster with both claws alike. The similar claws of these four cases were all nippers. Theoretically, it may appear quite plausible that a symmetry of this character might be congenital in origin. For in the early development of the lobster both chelæ are alike and similar to the nipper type. At about the sixth stage[4] normally one of the claws begins to differentiate into a crusher. We might thus have an adult lobster with two nipping claws because they had failed to differentiate in the usual asymmetrical manner. On the other hand, the writer has elsewhere[5] furnished evidence that this type of symmetry may also be brought about as the result of a process of regeneration.

(*b*) *Similar Crusher Claws.*—With regard to this second category, however, the congenital theory does not appear to apply so readily. For in this case the development must be conceived as starting in the normal way, and then instead of differentiating asymmetrically both chelæ have passed beyond the normal stages and developed into two crushing claws of the phylogenetically later (according to Stahr[6] and Przibram[7]) type.

[1] See especially: (1) Herrick, F. H., 1907, "Symmetry in the Big Claws of the Lobster," SCIENCE, Vol. XXV., p. 275. (2) Calman, W. T., 1906, in the "Proceedings of the Zoological Society of London," p. 633.

[2] Herrick, F. H., 1895, "The American Lobster," Bull. U. S. Fish Commission.

[3] Emmel, V. E., 1907, "Regenerated and Abnormal Appendages in the Lobster," thirty-sixth annual report of the Rhode Island Commission of Inland Fisheries, special paper, No. 31.

[4] Hadley, P. B., 1906, "Changes in Form and Color in Successive Stages of the American Lobster," thirty-fifth annual report of the Rhode Island Commission of Inland Fisheries, Special paper No. 19.

[5] Emmel, V. E., 1906, "Torsion and other Transitional Phenomena in the Regeneration of the Cheliped of the Lobster," *Journ. of Exp. Zoology*, Vol. III., No. 4.

[6] Stahr, H., 1898, "Neue Beiträge zur Morphologie der Hummerschere Jena," *Zeitschr. f. Naturw.*, Bd. 32.

[7] Przibram, H., 1901, "Experimentelle studien über Regeneration, I.," *Archiv. f. Entw.-Mech.*, Bd. XI.

With reference to this latter type of symmetry the following observations serve to emphasize the process of regeneration as a factor in the origin of such abnormal appendages.

Heretofore, a strong presumption has existed that a crusher claw would not be developed on each of the big chelæ, first because, as has already been indicated, the claws of the young lobster are alike and similar to the nipper type, and second, that in the adult lobster, the few cases of symmetrical claws were always of the nipper or embryonic type. Up to 1905 the only case recorded of two crushing claws on a lobster was in a foot-note to Herrick's[8] description of variations in lobster chelæ: "I have heard of a single case reported by a fisherman where similar crushing claws were developed on both sides of the body" (p. 143). To Przibram writing in 1901[9] this seemed such an incredible phenomenon that in view of the theoretical reasons indicated above, he concluded that "Der eine Fall von einer Hautung beiderseitigen" crushing claw "von dem Herrick nur vom Horensagen durch Fischer Kenntnis erhielt, wird wohl in der Reich der Fischermythen zu verweisen sein" (p. 333).[10]

Since the year 1905 three authentic cases of lobsters with two crushing claws have been placed on record. One of these was reported by Dr. W. T. Calman,[11] of the British Museum. He exhibits the photograph of a lobster (*Homarus gammarus,* Linn.) "with symmetrically developed chelæ" which were both crushers (p. 634). Herrick, '07,[12] observes that "this case is, for the present, essentially unique in the literature of the subject" (p. 277), but in making this statement he has evidently overlooked my description,[13] published in 1906, of the two other lobsters with similar crusher claws. The latter two cases of similar crushers were regeneration products, and they are, as far as I am aware, the only cases on record in which the origin of the two crushing chelæ is known, for in neither of the cases recorded by Herrick and Calman has the history of the abnormal chelæ been obtained. A brief restatement of the facts with regard to these regenerated crushers may, therefore, be in place here:[14]

One of these cases was obtained in the course of a series of experiments on regeneration made during the summer of 1905, and the other during similar experiments in 1906. In both instances the lobsters had been recently taken from the traps near the experiment station, placed in floating cars and kept in as normal a condition as possible. Let us designate the former as specimen A, and the latter as specimen B.

*Specimen A.*—The original appendages of this specimen were all normally developed and the animal was in a healthy condition throughout the experiment. The lobster was a female and measured $8\frac{3}{16}$ inches in length. On July 26, 1905, both chelæ, and the second and third right walking legs, were autotomously removed. On September 28, sixty-four days after the amputation, the lobster moulted and then measured $8\frac{1}{2}$ inches. It had meantime regenerated both chelæ, and the second and third right thoracic legs.

The original left claw of this lobster was a completely developed crusher, characterized by the wide massive claws with an almost entire absence of tactile hairs, and by the presence of broad tubercle-like teeth. The right chela was of a characteristic nipper type with a relatively slender claw, pointed cutting teeth, and a fringe of tactile hairs along the jaws. The right and left chelæ measured 146 and 140 mm. in length, respectively.

Soon after the amputation of these limbs another pair of chelæ began to regenerate from the remaining stump or basipodite. July 18, twenty-three days after the amputation, the regenerating buds both measured 5 mm. in length. By the time

[8] *Loc. cit.* (2).

[9] *Loc. cit.* (7).

[10] I gladly take this opportunity, however, to correct the impression which might be drawn from this quotation. For Przibram in a recent letter has kindly informed me that he has modified his earlier opinion with regard to this matter as the result of his studies on other crustacea. See especially page 215 of his monograph on "Die Heterochelie bei decapoden Crustaceen," *Archiv. f. Entw.-Mech.*, Bd. XIX., 1905.

[11] *Loc. cit.* (1).

[12] *Loc. cit.* (1).

[13] Emmel, V. E., 1906, "The Regeneration of Two Crusher-Claws following the amputation of the Normal Asymmetrical Chelæ of the Lobster," *Archiv. f. Entw.-Mech.*, Bd. XXII.

[14] For a more detailed description with figures, see *loc. cit.* (3), (13).

the segments of the future limbs were well outlined, attention was drawn to the very similar appearance of the two regenerating structures. Usually, as the lobster approaches the culmination of the moulting period, the regenerating chelæ become so clearly differentiated that a distinction between the crusher and nipper can be readily detected. In the present case, however, no characteristic differences could be observed between the right and left regenerating buds, and, moreover, the general morphological appearance of each suggested that *both* were developing into the crusher type of claws.

After the lobster had moulted, the regenerated chelæ assumed their normal shape and each measured 63 mm. in length. But the regenerative processes had not reproduced the original asymmetrical type of chelæ. The regenerated left claw was a true crusher like the former claw; but the regenerated right claw had the general characters, not of the nipper, but of a typical crusher. A close analysis of the structural features of the regenerated right claw demonstrated that, in all its morphological characters, it corresponded point for point with both the normal and the regenerated crusher of the left side, with respect to the general form, size and proportion, in the shape and arrangement of the teeth, and even in the number and distribution of the tufts of tactile hairs.

*Specimen B.*—This specimen was an eight-inch male lobster. The original chelæ, as in the preceding case, were also of the normal asymmetrical type, except that in this lobster the right claw was the crusher and the left a nipper. Each chela measured 162 mm. in length.

On August 4, 1906, both chelæ and the second left leg were autotomously removed. Soon after the operation another pair of limbs began to regenerate. By the time the segments of the future appendages were well outlined, the two regenerating chelæ looked very much alike, and the fact that their external characters resembled those of a crusher, suggested that both limbs would develop claws of a crushing type.

By the middle of October, 1906, the lobster had moulted and regenerated both chelæ and the second right leg. Each chela measured 111 mm. in length; they were remarkably similar in structure, and each displayed the character of a typical crushing claw.

In these lobsters, therefore, we have two cases in which the regenerated claws were symmetrical in form and of the crusher type of chelæ.

With regard to the origin of similar crusher chelæ, Dr. Calman's case has been interpreted as discrediting the regeneration theory for symmetrical chelæ, for in his discussion he says: It has been supposed that this might be due to regeneration after injury, since it is known that in Brachyura, on removal of the crushing-claw, a cutting-claw is regenerated. Przibram, however, failed to obtain such "heteromorphic" regeneration in the lobster, and the present specimen throws still further doubt on the regeneration theory, since it possesses a well-developed and quite typical crushing-chelæ on both sides of the body.[15]

Herrick in his earlier writing[16] has evidently also favored the congenital theory, for in his discussion of symmetrical claws he states that "there seems to be about as much variation as regards the details here mentioned in normal symmetrical claws as in the abnormally symmetrical ones, and it is probable that in either case the conditions met with are to some extent congenital" (p. 244). In his recent article he discusses both theories without definitely favoring either, and in conclusion states that, "The explanation just offered is based on the assumption that regeneration, following loss, actually occurs in these cases. If there has been no regeneration, we must then fall back upon the view that asymmetry in the great forceps is normally produced by changes which take place in the egg, so the rare condition of symmetry in these appendages may be casually brought about in the same way" (p. 277). With regard to Dr. Calmans's case of two crusher claws, Herrick suggests the possibility of getting such a condition through a process of regeneration. But it is important to note that neither of these writers furnishes any experimental proof for the conclusion that symmetrical crushing chelæ have arisen either congenitally or as the result of regeneration. The two cases just described furnish

[15] *Loc. cit.* (1).
[16] *Loc. cit.* (2).

such experimental proof, and *establish the fact that the process of regeneration is an important factor in the origin of the symmetrical chelæ occasionally found in the adult lobster.*

At present it seems difficult to bring these cases which show the regeneration of two crusher claws under any definite principles of regulation or a developmental mechanics. Evidently they can not be explained as due to a retardation in the process of ontogenetic differentiation, nor does it appear that they can be regarded as a reversion to a phylogenetically older type of chelæ. It is apparently impossible to interpret such a regeneration as a case of "compensatory regulation" in Zeleny's[17] sense, for the regenerated chelæ are almost identically similar in size and form. Nor is it clear that they both can be brought under the category of "reversal" phenomena, if by this term we mean a reversed order of asymmetry. At present, therefore, these cases must rather be described merely as the *substitution* by regeneration of the crusher claw in place of an original nipper chela.

II. *The Ontogenetic Origin of Normal Asymmetry.*

The main question here is, whether normal asymmetry is congenital and wholly predetermined in the egg, or whether it may be influenced by external factors during development.

With regard to this matter Herrick,[18] on the basis of his experiments with the shrimp *Alpheus*, concludes that asymmetry in the lobster "is probably one of direct inheritance, all members of a brood being either right- or left-handed. That is to say, the normal position of the toothed or crushing claw is not haphazard, but is predetermined in the egg" (p. 225). But here again there is a necessity for evidence, for it still remains to be demonstrated that such asymmetry in the lobster is thus predetermined. The results of some experiments made in order to determine whether the crusher could be developed on either side of the body by making appropriate mutilations during the larval stages, *i. e.*, at a period when the chelæ have not yet differentiated into nipper and crusher—may be here introduced. Although these experiments are still in progress, some of the data is already significant because it tends to support a different theory than that of direct inheritance.

On July 24, 1906, two groups of second-stage larval lobsters were mutilated. In group A, the right chela was amputated, and in group B, the left chela was removed in each specimen. The lobsters were kept in separate compartments and precaution taken to keep a careful record of mutilations, moults, and regenerations for each individual. Such an experiment is especially difficult because the naturally great mortality of larval lobsters when kept in artificial conditions is greatly increased by the injury attending mutilation, but I succeeded in rearing beyond the fourth stage four specimens in group A, and nine specimens in group B. After each moult the regenerated chela was

GROUP A: RIGHT CHELA REMOVED

| Specimen | Stage | Date of First Mutilation | Number of Moults | Character of the Chelæ | | |
|---|---|---|---|---|---|---|
| | | | | Date | Right | Left |
| 1 | 2d | July 24 | Six | Sept. 29 | Nipper | Crusher |
| 2 | 2d | " 24 | Six | Oct. 6 | Nipper | Crusher |
| 3 | 2d | " 24 | Six | Sept. 29 | Nipper | Crusher |
| 4 | 2d | " 24 | Six | Nov. 8 | Nipper | Crusher* |

GROUP B: LEFT CHELA REMOVED

| Specimen | Stage | Date of First Mutilation | Number of Moults | Date | Right | Left |
|---|---|---|---|---|---|---|
| 1 | 2d | July 24 | Six | Oct. 27 | Crusher | Nipper |
| 2 | 2d | " 24 | Six | Sept. 29 | Crusher | Nipper |
| 3 | 2d | " 24 | Six | Oct. 13 | (?)† | Nipper |
| 4 | 2d | " 24 | Six | Oct. 19 | Crusher | Nipper |
| 5 | 2d | " 24 | Six | Oct. 19 | Crusher | Nipper |
| 6 | 2d | " 24 | Six | Oct. 19 | Crusher | Nipper |
| 7 | 2d | " 24 | Six | Oct. 19 | Crusher | Nipper |
| 8 | 2d | " 24 | Six | Oct. 19 | (?)† | Nipper |
| 9 | 2d | " 24 | Six | Sept. 22 | Crusher | Nipper |

* This specimen was very late in displaying any asymmetrical differentiation, but by November 18 the left chela became somewhat broader, showed a characteristic crusher curve in the dactyl and tubercle-like teeth in the proximal region of each jaw.

† Up to date showed no evidence of having differentiated into a crusher.

[17] Zeleny, C., 1905, "Compensatory Regulation," *Jour. of Exp. Zoology*, Vol. II., No. 1.

[18] 1907, *loc. cit.* (1).

invariably amputated. The limb on the opposite side of the body was thus given every possible advantage with regard to growth, in order to see whether this chela could be made to differentiate into a crusher. The data so far obtained for these specimens is in the table given above.

From this table it will be observed that in over 90 per cent. of the specimens the chelæ have already differentiated asymmetrically, but in no case for group A did a crusher develop on the right side, or in group B, a crusher on the left side. The evidence for specimens Nos. 3 and 9 is at present neutral, for they still appear to retain their embryonic symmetry, and it remains to be seen at the next moult, which will occur during the spring, whether they too will finally develop a crusher on the right side or not. At any rate, this experiment clearly shows that *in all cases where the chelæ have differentiated far enough to display asymmetrical characters, the crusher has developed on the chela which was given the greater opportunity for growth; i. e.,* on the side which was not mutilated.

The results so far attained, therefore, establish a strong presumption that the "right- or left-handedness" of the lobster may not be entirely predetermined in the egg. If these results are confirmed by further experiments, it ought to furnish convincing proof that the asymmetrical relation of chelæ in the lobster may under certain conditions, at least, be determined by other than hereditary factors.

This result is especially interesting in view of the fact that in the adult lobster we do not seem to meet with the phenomenon of reversal or compensatory regulation which Zeleny[19] and Przibram[20] have found in other crustacea. In the course of my experiments I have mutilated over 200 adult lobsters in which the normal asymmetrical limbs were autotomously removed and preserved for each specimen, but in no case did a crusher ever regenerate on the side which had originally carried a nipper and at the same time *vice versa* for the nipper. It has been suggested that possibly one reason why we do not get a typical reversal in the lobster is because the asymmetry of chelæ consists in a greater qualitative differentiation than in the case of the crabs and some other decapod crustacea, consequently, a true reversal in the lobster would involve more fundamental morphological transformations than in the case of these other forms. On the other hand, in the larval lobster the chelæ are very similar both qualitatively and quantitatively, and the results of our experiments seem to indicate that the symmetrical relations of the organisms are at this stage in a much more plastic condition.

We may summarize, then, this discussion of regeneration and the origin of symmetry as follows: First, positive evidence has been advanced that the process of regeneration is an important factor in the origin of symmetrical chelæ. Second, the results of the foregoing experiments on the larval stages establish a strong presumption that the right- or left-handed asymmetry of the lobster, instead of being entirely hereditary, may be influenced during ontogenetic development by external factors.

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March 6, 1907

[19] *Loc. cit.* (17).

[20] *Loc. cit.* (7).

### DIE BACK OF THE PEACH TREES
### (*Valsa leucostoma* Pers.)

Die back is a serious enemy of the cherry orchards of Germany. It is especially destructive in the districts along the Rhine. It is also reported as being parasitic on the stone fruits of Australia. Professor F. C. Stewart, of the New York Agricultural Experiment Station, was the first American to call attention to the parasitic nature of this fungus. Ellis and Everhart in their 'North American Pyrenomycetes' state that this organism is found on peach, plum and almond trees in Carolina, Pennsylvania, New Jersey and probably throughout the country where the trees are found.

Experiments at this station show that it

is an active parasite attacking the twigs, limbs and trunk of the peach, plum, apricot and cherry trees.

On the peach, infection occurs through the buds and wounds at any time during the growing season, but its development is most noticeable during the spring months. Alternating freezing and warm periods during late winter appear to bring about favorable conditions for the growth of this organism. It often makes considerable advancement during the warm weather in winter. The young shoots are frequently killed back from two to fifteen inches during the months of January and February. As many as three hundred diseased twigs have been counted on a single tree. Twigs killed during the winter months at first have a dark purplish skin, but later the skin on the infected areas becomes leathery and shades into scarlet and purple, giving the twigs a characteristic appearance. The leathery colored areas finally change to drab, and the skin on the diseased tissue becomes loose and wrinkled. Black fruiting bodies (*Cytospora rubescens* Nitschke) soon appear below the epidermis on the drab-colored areas. These bodies gradually enlarge and push a white disk-like cap through a transverse slit in the epidermis. The entire dead portion of the twig gradually changes to drab in color and becomes more or less dotted with the black silvery capped pustules. During wet weather these black *Cytospora* bodies push out very fine red threads which are composed of masses of spores. These spores are soon scattered by the rain and insects and start new points of infection.

The diseased portion of the twig soon becomes constricted, making the division between the dead and living tissue very marked. Gum pockets also form at this point, which frequently rupture the epidermis and produce a copious gum flow.

During the spring and summer months the foliage of infected twigs frequently wilts suddenly and takes on a brown blighted appearance. This blighting is due to the fungus girdling the stem. A gradual killing back also occurs, but the injury in such case is not so noticeable.

Infections on the older branches during the winter and early spring months produce oblong wounds extending up and down the stem. The epidermis covering such wounds cracks and falls away exposing the wood. Callus soon pushes out from the edge of the injury and finally covers over the exposed tissue. The lips of the newly-formed bark, when they meet, do not unite and often leave a slit or opening through which gum exudes. Injuries of this sort finally produce slightly elevated, oval-shaped scars on the branch, and it is not uncommon to find from fifteen to twenty wounds and scars on a limb five or six feet long. In the more severe cases there is constantly an enlargement of branch about the point of injury, frequently producing rough, black barrel-shaped enlargements.

On the larger limbs and trunk, especially on the southwest side, large cankers or so-called sun scald wounds are formed. Such injuries are gradually extended, often girdling the limbs and even the trunk of the tree. The gumming is also constantly associated with these cankers.

Large limbs or even whole trees in different states of vegetation and at different times of the year die suddenly. The foliage of limbs or trees which die late in the spring and summer takes on an unhealthy, starved appearance and wilts suddenly and shrivels. The leaves of those that will die during the following winter in most cases also take on a yellowish color and fall prematurely.

On the infected areas of the limbs and trunk *Cytospora rubescens* Nitschke and *Valsa leucostoma* Pers. usually develop. Inoculations made with pure cultures of *Valsa leucostoma* on peach and plum trees produced wounds on which *Cytospora rubescens* invariably developed. Spores of *Valsa leucostoma* placed on sterilized peach twigs also produced *Cytospora rubescens*. Inoculations made with pure cultures of *Cytospora rubescens* on peach and plum trees produced wounds on which *Cytospora rubescens* constantly developed. *Cytospora rubescens*

spores placed on sterilized peach twigs soon reproduced the *Cytospora* form. From our experiments it is quite safe to conclude that *Cytospora rubescens* Nitschke is the pycnidial form of *Valsa leucostoma* Pers. The pustules of these two forms are constantly intermingled, except on the twigs where the perithecia seldom develop. These forms resemble each other so closely in size, shape and color that it is usually impossible to distinguish one from the other without the aid of a microscope. When the epidermis of diseased tissue is peeled off, these bodies remain attached to it and appear like blisters on its inner surface.

The disease injures the Japan plum in much the same way as the peach. A full account of this disease will be published in bulletin form by this station some time during the present year.

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## QUOTATIONS

### THE IMPERIAL CANCER RESEARCH FUND

The report of the Imperial Cancer Research Fund for the year 1906–7, presented to the general committee at their meeting under the presidency of the Prince of Wales on Monday, is calculated to impress different sections of the community in a somewhat different manner. By those who are uninstructed in scientific methods, and unacquainted with the caution necessary for the successful conduct of scientific inquiries, it is likely to be received with some impatience at the continued absence of definite results of a preventive or curative character; while those of better qualifications for the exercise of judgment will recognize that foundations are being laid which afford reasonable hope of a successful and permanent superstructure. The general summary of the superintendent, Dr. Bashford, states that, "during the past year, the hopes of advancing knowledge of cancer have become more and more centered in experimental investigations. We have learned from experiments more of the nature of the local and of the constitutional conditions associated with the origin of cancer; and we have been able to form more definite conceptions of the nature of the change responsible for the rapid multiplication of cancer-cells." The earlier conclusions that cancer is universal in vertebrate animals, without reference to the nature of their food, that its prevalence differs greatly in extent among different races of men, that it is frequently developed in parts of the body which are subjected to continued irritation, either from industrial pursuits or in association with native customs or religious rites, that it is often consecutive to some direct local injury, and that no single form of external agency is constantly associated with its development, have all been confirmed by subsequent observation and experiment. On these grounds it is pronounced to be futile to seek for a hypothetical something common to all the external agencies associated with cancer, and to be necessary to direct attention to the common intra-cellular change which, in conformity with the biological similarity of cancer throughout the vertebrates, must intervene in the transformation of normal into cancerous tissue. As there is no evidence to justify the assumption that the disease is communicated from one person to another, the search for the clue to cancer in any species of animal must take account of peculiarities in the individuals which are attacked and in those which escape. Hence, questions of individual and of family liability have received increased attention during the year.—The London *Times*.

## CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY

### LIGHT AND HEALTH

Surgeon Chas. E. Woodruff, of the United States Army, in some notes on "Actinophysiology and Actinotherapy," published in *American Medicine* (Philadelphia) for April, calls attention to the injurious effects of excessive sunlight, a subject on which he has already written several articles and one book. Among the points mentioned are the retardation of vegetable growth by sunlight; the injurious effects of sunlight upon animals; the retardation of human growth by sunlight, so

that the tallest men are found in the less sunny climates; the advantages of cloudy weather in increasing the vital activities; the value of dark forests as sanitaria; the dangers of too much light in the treatment of tuberculosis, etc. Many of Major Woodruff's ideas are certainly contrary to generally accepted notions regarding the importance of sunlight. He advocates playgrounds for city children, but adds, "let the parks be well shaded, and not the stunting sand baths which are so harmful." In closing his notes, Major Woodruff laments the fact that climatologists have been so slow to take up the study of light, and calls attention to the well-known lack of careful and systematic observations of the intensity of sunlight. It is well that medical men should spur on climatologists to take more and better observations along many lines, and Major Woodruff's interesting views, and his enthusiastic advocacy of them, will serve a useful purpose if they lead to further investigation by meteorologists and climatologists along actinometric lines.

### FRESH WATER IN A WATERSPOUT

Waterspouts—perhaps often better called cloud-spouts—seem to draw up water from the surface over which they occur, and it is, therefore, not infrequently believed that they are largely composed of salt water in cases where they are seen over the oceans. There is an old story of a vessel which passed through a waterspout (quoted in Davis's "Elementary Meteorology," page 283). The captain was drenched in a downpour of water, which nearly washed him overboard. On being asked whether he had tasted the water he replied: "Taste it. I could not help tasting it. It ran into my mouth, nose, eyes and ears." "Was it then fresh or salt?" he was asked. "As fresh," said the captain, "as ever I tasted spring water in my life." In *Symons's Meteorological Magazine* for April, 1907, there is an account of waterspouts which were encountered by the British steamship *Dalyarth* in the Euxine, July 15, 1906. The steamer passed within one half mile of the spouts. "There was a sound of broken water, resembling distant surf on a beach; a terrific deluge of rain, which obscured all view of the waterspout—even the lightning failed to penetrate through the downpouring sheets of water. The falling water was fresh." Dead fish were later seen lying on the surface of the water, and some even fell on the decks of the steamship.

### DUST WHIRL AT JOHANNESBURG

Photographs of dust whirls are not abundant, and those who are interested in such matters may be glad to note the publication of two views of a dust whirl in the "Report of the Director of the Transvaal Meteorological Department for the year ending June 30, 1906" (Pretoria, 1907). October 21 was calm and hot at Johannesburg, the conditions being favorable for the production of dust whirls. Several large ones were seen during the day. One of them, which passed over the suburbs, did some damage. The two views show different stages of the same whirl.

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## *CURRENT NOTES ON LAND FORMS*

### EARTHQUAKE FISSURES AND SCARPS

A summarized description of fissures and scarps due to earthquakes is presented by W. H. Hobbs in his essay "On Some Principles of Seismic Geology" (*Beitr. zur Geophysik*, VIII., 1907, 219–292), under the title "Dislocations at the Earth's Surface as the Result of Macroseisms" (pp. 236–253). Thirty-one examples are cited. Some of the most important are as follows: In India at the head of the Arabian Sea, 1819, the scarp "rose like a wall above the plain, 16 miles in length," with a vertical displacement of 20 feet; near Wellington, New Zealand, 1855, a cleft was formed for 90 miles with a displacement of 9 feet; in Tulare County, California, 1856, a fissure "in a uniform direction for a distance of 200 miles"; at Fort Tejon, California, 1857, a fissure 20 feet wide and 40 miles long; in Owens Valley, California, 1872, a scarp was formed 40 miles long and from 5 to 20 feet in height; in the Tarawera district, New Zea-

land, 1886, the main cleft was about 6 miles long, nearly straight; in the Sonora district of Arizona and Mexico, 1887, an irregular fissure, 35 miles long, with a displacement from 8 to over 20 feet; in the Neo valley, Japan, the Mino-Owari earthquake of 1891 produced a scarp for 40 miles, with a displacement of more than 10 meters; northwestern India, 1892, a fissure 120 miles in length; and finally the long fissure of the San Francisco earthquake of 1906. In several cases, the new fissures followed lines of depression or subdued scarps, presumably formed by earlier earthquakes.

It would be of interest, in comparing these seismic features with the straight lines representing "lineaments" which Hobbs in this and other papers draws through points where earthquakes have been recorded and along lines of coasts or valleys, to inquire carefully into the course followed by observed fissures and scarps, in order to determine how far they would give warrant for the rectilinear course of hypothetical lineaments (rectilinear, at least, on the maps employed). As far as data are at hand, it does not appear that observed fissures and scarps are straight enough to give support to Hobbs's lines, which in any case seem, as far as earthquakes are concerned, to be largely influenced in location and direction by the evidently subjective element of the location of cities and villages where observers are numerous. For example, in the absence of evidence as to recent or ancient fault lines, the fact that earthquakes have been recorded at Springfield, Hartford and New Haven is no sufficient reason for thinking that seismotectonic information can be gained by drawing a straight line across Connecticut into Massachusetts through these three cities (see Fig. 7, p. 268); indeed, there is even less reason for thinking that seismotectonic lines should be closely related to centers of urban population than that rivers should run by large cities.

### FAULT SCARPS AND FAULT-LINE SCARPS

The relation of earthquake scarps to modern and to ancient faults is to-day well proved. The San Francisco earthquake fracture followed, for at least part of its length, a previously known fault line of thousands of feet displacement, along which the signs of geologically recent movement were so manifest that those familiar with the ground had for some years expected the occurrence of further disturbance. The long fault line at the base of the Wasatch range in Utah, with its recent scarps across alluvial fans and flood plains, is well known through Gilbert's reports. These and other geologically modern fault lines are all more or less curved or irregular. Many other faults are so ancient that the faulted mass may have been baseleveled and afterwards broadly uplifted (without renewed displacement) so as to suffer revived erosion, whereby the weaker rocks, whether in the heaved or in the thrown block, have been worn away; thus fault-line scarps, as they may be called, are produced. Such a scarp differs from a fault scarp in various significant respects. A *fault scarp* is a direct measure of differential displacement, except in so far as it is defaced and dissected by erosion; its altitude equals the vertical displacement of the fault; its length equals the length of the fault; it always faces from the heaved to the thrown block. A *fault-line scarp* in its most characteristic development—namely, where the original displacement has been baseleveled in a completed cycle of erosion, and where the succeeding cycle has reached early maturity—faces the side of the weaker rocks; its altitude has practically no relation to the original displacement, but depends on the amount of elevation by which the new cycle is introduced, or on the thickness of the body of weak rocks. The length of such a scarp is not a measure of the original fault length, but of the distance over which rocks of unlike resistance happened to be brought next to each other by the faulting. When a fault-line scarp faces the heaved block it may be described as a topographically reversed fault-line scarp; but care must be taken not to confound it with a "reversed fault" of geological nomenclature. When the rocks on the two sides of a baseleveled fault are of the same hard-

ness, then revived erosion may produce, in the early youth of the new cycle, a fault-line valley; the work of a consequent or of a subsequent stream, as the case may be.

This problem is only a special phase of the general treatment of faults from the physiographic instead of from the geologic point of view. For the geologist, once a fault, always a fault; displacement, length, heaved block, thrown block, etc., retain their values and their names indefinitely. For the physiographer, once a fault scarp, afterwards something else: the scarp retreats from the fault line; inequality of level across the fault line ordinarily decreases and ultimately vanishes, but it may for a time be reversed even in the first cycle of erosion; if a completed cycle is followed by uplift, revived erosion may produce a narrow fault-line valley; or a fault-line scarp, the aspect, height and length of which have no definite relation to the aspect and dimensions of the original displacement. The effects of insufficient attention to the physiographic aspects of faulting are illustrated in the following note, as well as in a current discussion on "How should faults be named and classified" in the *Economic Geologist,* where consideration is given only the underground elements, as is natural enough in a geological discussion, though somewhat inappropriate to the general title under which the discussion has been carried on.

### FAULT-LINE SCARPS IN SWEDEN

THE uplands of central Sweden possess a number of well-defined scarps, which are described by Gunnar Andersson as due to faulting, with only subordinate modification by erosion ("Om Mälaretrakternas geografi," *Ymer-tidskrift utgifven of Svenska sällskabet för antropologi och geografi,* 1903, 1–64). For reasons stated below, these features are better interpreted as fault-line scarps; but however they are regarded, they give no countenance whatever for drawing rectilinear structural lines or "lineaments" between points from which earthquake reports are received. It is true that many of the Swedish scarps have a rough east-west trend; but it would be quite impossible to determine the further extension of any one of them by continuing the trend of even the least curved part of its irregular course. These fault lines, along with many others, prove that the highly exceptional quality of a straight line is not to be expected in crustal dislocations.

Andersson infers a modern (Tertiary) date for the faults of central Sweden, because the scarps along the fault lines are still well defined; but in reaching this conclusion he has taken no account of the possibility of two cycles of erosion. He argues that, if the faults were ancient, their scarps would have been long ago planed down by erosion. On the other hand, it is manifest that even if the faults were of paleozoic date, the scarps might be distinct to-day if, after having been baseleveled, they were re-developed by the removal of weak rocks along one side of the fault line in a new cycle of erosion. That at least two cycles of erosion since the period of faulting must here be reckoned with is strongly indicated by the occurrence of numerous narrow fault-line valleys through districts of resistant crystalline rocks; the uplands on either side being of essentially equal height. An account of some striking examples of these narrow valleys is given by A. Larsson, "Topografiska studier i Stockholmstrakten," *Ymer,* 1906, 273–292. Near by, along parts of the same fault lines or of similar fault lines, well-defined scarps separate uplands of crystalline rocks from lowlands in which the crystallines are at least in some instances patched with small remnants of a former unconformable cover of relatively weak paleozoic strata. In these instances there is good reason for thinking that the now lower ground was, at the beginning of the present cycle of erosion, filled up to the level of the crystalline uplands with the paleozoic strata; and hence that while the erosion by which the fault-line scarps were developed may well be of Tertiary date, the date of the faults must be decidedly earlier.

The district here considered, lying not far west of Stockholm, will presumably be visited by excursions at the time of the next International Geological Congress in 1910. It is as

unique in its way as are the zigzag ridges of the Pennsylvania Alleghenies. Its development, on the more-than-one-cycle scheme, appears to have been as follows: The great body of complicated crystalline rocks was effectively baseleveled in ancient times, and covered unconformably with early paleozoic strata. The compound mass was afterwards broken by numerous faults, which divided it into many irregular, (nearly) vertical prisms; and the prisms were irregularly jostled and tilted. At that time the surface must have been characterized by many displaced blocks, topped with paleozoic strata and separated by fault scarps. Then the whole district was again baseleveled; this being indicated by the general accordance of upland heights to-day, irrespective of faults. On the peneplain thus produced, the paleozoic strata would remain only where they lay below baselevel. A broad upwarping introduced a new cycle, which has now advanced (glacial erosion included) so far as to have almost entirely consumed the previously inaccessible remnant-covers of paleozoic strata, thus developing fault-line scarps in good number; while the fault lines through the crystalline uplands are now marked by narrow fault-line valleys.

This case is similar in some respects to that of the Hurricane ledge in Arizona, next north of the Colorado canyon. When first described by Dutton (Monogr. II., U. S. Geol. Surv.), this strong escarpment was interpreted as marking a recent fault, and its height was taken as a measure of the fault. Reasons have since been given for believing that the fault is not recent (where the N-S fault line crosses certain erosional E-W escarpments, the corresponding members of the latter are out of line by several miles, and this departure from alignment must represent the excess of escarpment retreat in the heaved block over that in the thrown block); that the original displacement was essentially obliterated by baseleveling (a level, unbroken lava flow crosses the fault line at one point, passing evenly from strong to weak rocks); and that the existing scarp is a fault-line scarp produced by the action of revived erosion on the weaker strata along one side of the fault line. W. M. D.

## *STAFF OF THE ROCKEFELLER INSTITUTE*

THE Rockefeller Institute for Medical Research has adopted as titles for its staff member, associate member, associate, assistant, fellow and scholar of the Rockefeller Institute, and has made the following list of appointments:

*Member of the Institute and Director of the Laboratories*—Simon Flexner, pathology.

*Member of the Institute*—S. J. Meltzer, physiology and pharmacology; E. L. Opie, pathology; P. A. Levene, biological chemistry.

*Assistants of the Institute*—Hideyo Noguchi, pathology; John Auer, physiology; Alexis Carrel, experimental surgery; J. W. Jobling, pathology; Nellie E. Goldthwaite, chemistry.

*Fellows of the Institute.*—C. M. A. Stine, biological chemistry; Donald Van Slyke, biological chemistry; Martha Wollstein, pathology; Maud L. Menten, pathology; Mabel P. Fitzgerald, bacteriology; Don R. Joseph, physiology; Benjamin T. Terry, protozoology; Thomas W. Clarke, pathology.

*Scholar of the Institute*—Bertha I. Barker, pathology.

Grants to aid special researches have been made to the following: Robert M. Brown, New York; C. H. Bunting, Charlottesville, Va.; Katherine Collins, New York; Cyrus W. Field, New York; N. B. Foster, New York; Joel Goldthwaite, Boston; Holmes C. Jackson, Albany; Arthur I. Kendall, New York; Waldemar Koch, Chicago; W. G. MacCallum, Baltimore; Wilfred H. Manwaring, Bloomington, Ind.; J. W. D. Maury, New York; F. G. Novy, Ann Arbor; W. Ophüls, San Francisco; Richard M. Pearce, Albany; H. T. Ricketts, Chicago; Hermann W. Schulte, New York; Charles E. Simon, Baltimore; Aldred S. Warthin, Ann Arbor; Francis C. Wood, New York.

## *SCIENTIFIC NOTES AND NEWS*

SIR JOSEPH D. HOOKER, who celebrated his ninetieth birthday on June 30, has been made a member of the Order of Merit.

Lord Lister was on June 28, at the Guildhall, presented with the freedom of the City of London in a gold casket, in recognition of "the invaluable services rendered to humanity by his discovery of the antiseptic system of treatment in surgery."

Professor William James has been elected a corresponding member of the British Academy.

At its recent commencement, Brown University conferred its doctorate of laws on Dr. C. Barus, professor of physics and dean of the graduate department, and the degree of doctor of science on Dr. Wallace C. Sabine, professor of physics at Harvard University and dean of the Lawrence Scientific School.

Lafayette College has conferred the degree of doctor of science on President F. W. McNair, of the Michigan College of Mines.

The University of Manchester has conferred the doctorate of science on Dr. George E. Hale, director of the Solar Observatory of the Carnegie Institution and the degree of doctor of laws on Baron Kikuchi, lately minister of education in Japan.

Dr. Oscar Loew, since 1901 professor of agricultural chemistry in the University of Tokyo, has accepted the position of chemist in the Porto Rico Agricultural Experiment Station.

Dr. W. A. Henry, professor of agriculture in the University of Wisconsin since 1880, director of the Agricultural Experiment Station since 1887 and dean of the College of Agriculture since 1892, has been made professor emeritus. He proposes to make his home in Wallingford, Conn.

Mr. W. P. Pyecraft has been appointed assistant on the permanent staff of the zoological department of the British Museum.

Sir E. Maunde Thompson, director of the British Museum, has been elected president of the British Academy.

Dr. Wilfred H. Manwaring, head of the Department of Pathology in Indiana University, sailed from New York on July 14, to spend two years in research in European laboratories, under the auspices of the Rockefeller Institute for Medical Research. His address will be: Care of Dresdener Bank, Berlin.

The cooperative studies of the Atlantic Coastal Plain stratigraphy being conducted by the United States and the various State Geological Surveys were begun in South Carolina on July 1. Several parties will be in the field during the summer and autumn under the supervision of M. L. Fuller of the United States Geological Survey, acting in cooperation with Dr. Earle Sloan, state geologist of South Carolina.

Dr. John M. Clarke, director of the New York Geological Survey, will attend the centenary of the Geological Society of London as delegate from the state survey and from the Section of Geology, American Association for the Advancement of Science. The organization of the London society stimulated in very large measure that interest in geological science in America which gave birth to the earliest state surveys and the influence of its membership was particularly manifested in the original conception and execution of the New York Survey, which was organized in 1836 and has had an uninterrupted existence of seventy-one years. William Smith, Bigsby, De la Beche and Conybeare molded the ideas of early American geologists, and the personal influence of Murchison and Lyell upon James Hall was largely responsible for the classification of the New York series of geological formations. Dr. Clarke also attends the meeting of the Geological Society of Germany in Basel, whence a two weeks' trip across the Alps will be made under the guidance of the German and Swiss Geologists.

Dr. Hermann von Schrenk has resigned from the U. S. Department of Agriculture, with which he has been connected for the last eleven years, and, with two of his former assistants, has opened an office as consulting timber engineer at St. Louis. The name of the firm is von Schrenk, Fulks and Kammerer. Dr. von Schrenk has been appointed pathologist of the Missouri Botanical Garden, where he will have a fully-equipped pathological laboratory with one or more assistants.

We learn from *Nature* that the council of the Royal Society of Edinburgh has awarded the Keith prize for the biennial period 1903–5 to Dr. Thomas H. Bryce for his two papers on "The Histology of the Blood of the Larva of *Lepidosiren paradoxa*," published in the *Transactions* of the society; and the Makdougall-Brisbane prize for the biennial period 1904–6 to Dr. Jacob E. Halm for his two papers on "Spectroscopic Observations of the Rotation of the Sun" and "Some Further Results obtained with the Spectroheliometer," and for other astronomical and mathematical papers published in the *Transactions* and *Proceedings* of the society.

Dr. James Merrill Safford, emeritus professor of geology in Vanderbilt University and for many years state geologist of Tennessee, died at Dallas on July 3, at the age of eighty-five years.

Sir William Perkin, F.R.S., the eminent British chemist, died in London on June 14, at the age of sixty-nine years.

Sir William C. Gairdner, F.R.S., formerly professor of medicine in the University of Glasgow, died on June 28, at the age of eighty-two years.

Civil service examinations are announced as follows: On August 5, to fill two or three vacancies in the position of aid in arboriculture in the Bureau of Plant Industry, at salaries ranging from $600 to $1,000; on August 14 and 15 for the position of computer in the Supervising Architect's Office, at a salary of $1,000 to $1,600, and on August 14 and 15 for scientific assistant in animal pathology in the Bureau of Animal Industry, at a salary of $840.

A telegram has been received at the Harvard College Observatory from Professor Percival Lowell, director of the Lowell Observatory, stating that "South American Lowell Expedition cables double canals seen, oases photographed."

The trustees of the Geologists' Association have transferred to the University of London the library of the association now at University College on condition that it form part of the library of University College.

The fifth meeting of the Association of Economic Biologists has been held at the Imperial Institute, South Kensington, London, under the presidency of Mr. A. E. Shipley, F.R.S.

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## UNIVERSITY AND EDUCATIONAL NEWS

The late M. Commercy has left $800,000 to the University of Paris for scholarships for scientific research.

Mr. Andrew Carnegie has given $25,000 to Roanoke College, which has collected $35,000 on which this gift was conditional.

*The Experiment Station Record* states that at the Massachusetts College a department of agricultural education has been established, its duties to include both instruction and research. This is an entirely new departure at the college and is believed to be the first attempt in this country to organize this kind of work on so broad a foundation. Normal courses will be offered to prospective teachers, and studies will be made of problems confronting agricultural teaching in colleges and schools of various grades, and of agricultural extension with a view to introducing agriculture into the elementary schools, establishing agricultural high schools, and correlating and unifying the agricultural instruction given in the state. The work will be in close cooperation with existing educational agencies, especially the state industrial commission. W. R. Hart, of the Nebraska State Normal School, who has had long experience in teaching and is the author of a number of monographs and other articles on educational topics, has been selected as the head of the department and will begin his duties with the next college year.

Dr. Alex. Hill and Sir Thomas Raleigh, commissioners of the treasury, have made to the Liverpool Corporation a report dealing in detail with the several departments of the university in view of the renewal of the grant of £10,000 to the university by the corporation. The commissioners praise the work that is being done at the university, and the finance

committee of the corporation has recommended that the grant be renewed for 1907.

A STATUTE will be brought forward in October for establishing at Oxford a professorship of engineering science, for which a sum of not less than £800 per annum, inclusive of a fellowship, has been guaranteed for five years. It is proposed that the professor shall lecture and give laboratory, but not workshop, instruction; and he will have charge of any engineering laboratory that may be assigned him by the university.

DR. WINFIELD SCOTT CHAPLIN has resigned the chancellorship of Washington University.

PROFESSOR HARRY A. GARFIELD, who occupies the chair of politics at Princeton University, has been elected president of Williams College to succeed President Henry Hopkins, who will retire at the close of the next academic year, when he will have passed the age of seventy years. Professor Garfield graduated from Williams College in 1885; he is the son of President James A. Garfield, of the class of 1856. President Hopkins graduated from Williams College in 1858, his father, the Rev. Mark Hopkins, having been president of the institution for thirty-six years.

DR. C. H. GORDON, assistant geologist of the Geological Survey, will occupy the newly-established chair of geology and mineralogy in the University of Tennessee.

DR. M. A. CHRYSLER, instructor in botany at Harvard University, has accepted a position as associate professor of botany at the University of Maine.

AT a recent meeting of the board of trustees of the University of Illinois, the following promotions and additions were made in the department of psychology: Dr. Stephen S. Colvin, associate professor, to be professor; Dr. John W. Baird, instructor, to be assistant professor; Dr. Fred Kuhlmann, assistant in psychology at Cark University, to be instructor. The department has grown rapidly in numbers in the last few years. It will be given new and ample quarters in the addition to the Natural History Building which will probably be open for use in September, 1908.

E. J. WILCZYNSKI, Ph.D. (Berlin), associate professor of mathematics in the University of California, has accepted a similar position in the University of Illinois. Professor Wilczynski is the author of numerous articles and of a work on *Projective Differential Geometry of Curves and Ruled Surfaces* published by B. G. Teubner, of Leipzig, in 1906. He has been both research assistant and research associate of the Carnegie Institution, and he was one of the lecturers at the Colloquium of the American Mathematical Society held at Yale University during last summer. He was also one of the organizers of the San Francisco Section of the American Mathematical Society and was elected chairman of this section at its last annual meeting.

AT the recent meeting of the Board of Regents of the West Virginia University the following additions and promotions were made in the college of agriculture: John L. Sheldon, Ph.D., bacteriologist and plant pathologist of the West Virginia experiment station, was elected to the professorship of bacteriology and plant pathology in the university. W. M. Munson, Ph.D., professor of horticulture and horticulturist, Maine Experiment Station, was elected horticulturist of the West Virginia Station; T. C. Johnson, A.M., instructor in horticulture and botany, was promoted to an assistant professorship in the same subjects in the College of Agriculture, and D. W. Working, A.B., A.M., of Denver, Colorado, and formerly on the editorial staff of the *American Grange Bulletin*, was elected superintendent of agricultural extension teaching in the College of Agriculture. Also an order was passed authorizing the establishment of a department of highway construction in the college of agriculture.

THE board of trustees of the Sioux City College of Medicine announces the following changes in its faculty: C. T. Stevens, professor of biology; W. W. Scott, professor of chemistry; Dr. Delmar S. Davis, assistant professor of chemistry; Dr. George S. Browning, professor of infectious diseases, and the Hon. W. L. Harding, professor of medical jurisprudence.